

TEACHERS' PRACTICE UNDER THE ETHNOMATHEMATICAL PERSPECTIVE: A STUDY CASE IN YOUNG AND ADULT EDUCATION

Maria Cecilia de Castello Branco Fantinato

Universidade Federal Fluminense

This paper discusses the results of a case study, which investigated a middle school maths teacher's practice under an ethnomathematical perspective when teaching a group of students from young and adult education. Taking into account the dialogical interactions among the many and varied shapes of mathematical knowledge, this study tried to analyse not only the possibilities of teaching grounded on an ethnomathematical posture, but also the development of knowledge learning processes in a young and adult education classroom. It is pointed out that a long and continuous process of knowledge legitimation, for both teachers and students, characterizes teachers' practice under this perspective.

INTRODUCTION

This article aims at delivering the results of a research named *Ethnomathematics and EJA teachers' continuous education: construction of dialogical spaces among varied mathematical knowledges*, which looked into the role of a Mathematics teacher under the ethnomathematics perspective in a young and adult education classroom[1].

First, this text will analyze some of the contributions of ethnomathematics to the field of young and adult education. Then, we present the methodological aspects, which helped us build this research. The third part of this article will show the results of this investigation, focusing dialogue disposition, the ability to establish relations and the experience of autonomy. The last part, the final considerations will indicate that an ethnomathematical approach in teachers' practice favours the process of knowledge legitimacy as a dual carriageway.

ETHNOMATHEMATICS AND YOUNG AND ADULT EDUCATION

Ethnomathematics is a branch in research and study within Mathematics Education, which has several contributions to offer to young and adult education.

Ethnomathematics, as a research area aimed at representing/ perceiving/ shaping spatial and qualitative relations of diverse cultural forms, has been offering theoretical grounds to understand the many ways different sociocultural groups reason their mathematical knowledges. As for these students, the young and the adults ones, these knowledges are built along their domestic and professional lives and their previous academical experiences.

Most students who belong to young and adult education classes portray cultural roots, which have been socially, economically and culturally marginalized. The

ethnomathematical proposal not only acknowledges these experiences, but also allows a new perspective on the student: one who can develop mathematical knowledge. Therefore, it stimulates the *cultural dignity retrieval*, which is related to the ethnomathematics “political dimension” (D’Ambrosio, 2001). It is one of the most meaningful contributions to the researches in ethnomathematics towards pedagogical practices for young and adult students.

One of the challenges of young and adult education has been to work with a sociocultural group marked by several kinds of diversity, such as of age, religion, race, origin, and yet share of one or more experiences of social exclusion. Another challenge to researches in ethnomathematics which aim at investigating young and adults mathematical knowledges is the academic environment itself for many reasons: it does not stimulate students individual knowledges; it had rashly excluded them from its surroundings and consequently mining their self-esteem as learners.

According to D’Ambrosio (2001), ethnomathematics has an “educational dimension”. However, the relations between ethnomathematics and the educational field have not been able to avoid conflicts as ethnomathematics welcome multiple forms of quantitative and spatial representations of the world and this concept clashes with the idea of a single, universal mathematics offered by schools’ homogenized curriculum. As a result, very few practical indications have been made towards an ethnomathematical pedagogical program (Santos, 2004). Working under an ethnomathematical perspective means to deal with contradictions between the homogenous academic mathematics and the diverse mathematical knowledges present in the classroom[2].

In order to accomplish such goal, and approaching the same problem by a different angle, in this research ethnomathematics was used as the theoretical means to establish dialogue between the several mathematical knowledges mediated by the teacher.

In the young and adult educational context, richness and cultural complex dynamics are found among the different and diverse types of knowledges. In previous research (Fantinato, 2003), it was observed the usage of different calculation procedures among young and adult students in order to confirm a result. For example, informal procedures were used merely for the confirmation of a mathematical result, because any other procedure, such as one of academic type, couldn’t guarantee the required accuracy. These peculiar systems of reasoning are barely noticed to outsiders as they take an invisible character. They coexist with others and are considered, by these young/adult students as more *suitable* to the educational environment in general, these practices result from past or present experiences at educational surroundings, what Fonseca (2001) has named “reminisces of schooling mathematics”.

However, it is important to keep in mind that the mathematics teacher stands for the official mathematics image in the classroom. This person holds a knowledge considered *superior* students daily knowledge due to its privileged social position in our society. This uneven *status* position interferes in the relations among different

types of knowledges, which take part in the classroom cultural dynamics. When voicing students' knowledges, the dialogic attitude of the teacher entails an awareness of the mythical status of *his* math and the depreciation of *other* math as an effort to reverse this difference.

Therefore, ethnomathematics area has a lot to contribute to the development of sensibility approach towards the knowledge of the *other*. The research tried to indicate how a teacher's dialogic generous attitude could contribute to building bridges between mathematical diverse knowledges in young and adult education classroom contexts.

THE RESEARCH

To the development of this research, we are going to present the results of a *case study* based on a math teacher who deals with young and adult education, who had been taking part in an ongoing teacher development program on *ethnomathematical approach*. The choice for this methodology is due to the need to deepen comprehension on the cultural dialogue knowledge this teacher sets with his students – young and adult students, in relation to the mathematical knowledges found in these multicultural groups. It is also justified by the distinctiveness of this teacher who has been reviewing his practice grounded on the ethnomathematical studies.

The theoretical and methodological dimension used in this research presupposed the consideration of all participants in the dialogue between the diverse mathematical knowledges in the classroom. Teachers' and students' mathematical knowledges, as much as the teacher's awareness of his pedagogical choices, his transformation process from an ethnomathematical point of view have all been studied. It is a qualitative research, in which both UFF's ethnomathematical study and research group[3] and the teacher have been objects of study.

The methodological procedures included interviews, made at different moments of the process, with the professional chosen. There were also interviews with some of the students from the selected group, participative observation of the math classes in young and adult education groups and scrutiny of the logbook notes. We analyzed the teacher's pedagogical support documents, the written documents produced by the students of this teacher throughout the proposed math activities and the group meetings diary.

André Luiz Gils is a 40-year-old math teacher who has nearly twenty years teaching experience in private and public middle high and junior high schools. He is one of the founders of *UFF's Ethnomathematical Group* and he has been actively working with young and adult education for six years; due to André's specific characteristics, he was chosen to be subject of study. His professional path and practice fulfilled the objectives of the exploration. Besides, he also offered unique and specific characteristics proper to a case study. (Stake, 1992).

The chosen group of students were André's belonged to second UP[4] from Block I, in CIEP Anita Malfatti, a municipal school placed in Campo Grande, West Rio de Janeiro. When we started the classroom's observations, they were at the second half of 2005. These classes always took place every Monday night. The investigation data, on André's pedagogical practice in the classroom, were carried out by the two researchers and recorded on logbooks. In the school, there were also interviews with some students from the selected group, a little before classes started, in the cafeteria, or in their classroom.

TEACHERS' PRACTICE UNDER THE ETHNOMATHEMATICAL PERSPECTIVE

Here, some research results will be presented, particularly in terms of André's pedagogical practice in the classroom, noticeable from classes' observation, his own reports and from students' point of view as well. Considering his ethnomathematical teaching practice, three aspects stood out: dialogue disposition, ability to establish relations and the experience of autonomy.

Dialogue disposition

One of the main goals of ethnomathematics is to listen to the voices of the subjects who belong to the group, which was selected to be observed, that is, the legitimacy of the other's knowledge and the way they interpret reality (Domite, 2005). An ethnomathematical attitude supposes a disposition to dialogue, an attitude of respect to differences. The routine in André's classroom is built on permanent dialogue with his students.

One of the strategies used to get class started is to motivate students raising previous knowledges on the topic to be studied. "Who has already heard about fractions?" Students jump to answer eagerly, giving various examples from their daily lives: "book recipes have lots of them" (female student); "in paint gallons" (male student); "cooking Jell-O, add a certain amount of water, a certain amount of gelatin" (female student). Little by little, taking advantage of students' participation, André keeps building his class.

Besides thought provoking their participation, André recurrently legitimates their contribution, such as with; "It all brings the idea of fraction. What is more, you said you had not a single clue about it. Who would wonder? Perfect!" Students seem to feel at ease to convey their opinions and to question, unafraid of mistakes. Clara, one of his students admits "(...) he has a very caring peculiar teaching ability. He explains and makes us at ease in his class." Léa, another student, states: "what I don't understand ...I have enough freedom to ask him, because I know he'll gladly answer and help us".

André's class is not silent, many of them take part in the class - some from their free will, others because they were asked. Students, share this soothe, open atmosphere,

and identify it as one of the characteristics of his class. “He is the best teacher of this school. If you ask him anything, he answers. Some teachers don’t even let students ask a single question”.

Students also point out he is always ready to clear the questions they might have, even when class is over, as we can notice in the statements below:

He can see what we don’t understand, do you understand? He talks to us and manages to explain attentively and when class finishes and he is required, he is available as well. He never says no when it comes to teach us, can you see? I guess it is important, isn’t it?

Whenever I can’t understand I... go to him ... and ask him and he clears what I hadn’t understood, and then, it is much clearer to me.

While spurring the group during the dialogical exposition, André keeps walking around the room, trying to observe the individual ways to handle questions, asking them to explain their argument. André’s pedagogical practice attends some of Paulo Freire’s (1974) *dialogical* ground characteristics, which he himself refers to as *an opening to the other, modesty, faith* in men and reciprocal *confidence*. His disposition to dialogue has also broadened his ability and capacity to understand his students. In his words:

The chance to be teaching at EJA is also the chance to learn. There, I learn a lot. I learn to make electrical wiring, the proper usage of paint, I learn how to use plaster, I learn how to make concrete. Things I never imagined I would possibly learn. I was not raised for that but I learned because I wanted to and because I realized these were all knowledges as well.

The teacher’s ethnomathematical attitude seems to favor this availability to dialogue with knowledges different from his, not only to legitimate them, but also to learn with them, under the belief that these mathematical alternatives can change the way math is conceived as well, as Barton (2004) points out. The multicultural mosaic conditions in EJA’s classrooms (De Vargas, 2003) seem to contribute to this sort of sensibility of the dialogical teacher for other forms of mathematical representation of the world.

Ability to establish relations

Another characteristic of André’s teaching practice is to establish many types of relations. André is always searching for relations between academic and day-to-day knowledges. Sometimes, these relations are set from spontaneous situations brought in by the students. Some other times, they belong to the role of didactical strategies used to teach a certain mathematical topic. In the situation described below, the teacher seeks a connection between daily and educational knowledge:

André asks the students, “Has anybody else brought any more packages?” They hand in toothpaste, soap bars, shampoo, and ketchup ones. A student says, “I went to the market and got some cookies”, and André takes that one as well. Another student makes this

comment: “Well, it is an easier way to learn”. André goes to the board and writes *equivalence = the same amount*. He then gets two of the packages they brought and ask if they are equivalent. The teacher keeps showing the different packages and setting the comparisons. At a certain point, he shows two small packages, the ketchup one and the mayonnaise one and asks if they are equivalent. Léa, a student, disagrees. He queries, “Are you sure?” Then, he checks both packages’ weighs and gets surprised. He realizes they indeed didn’t really have the same weigh. The teacher asks how she reached that conclusion. Léa says the red one has more because it is a bit bigger. The researcher asks if it was a naked eye measurement, and Léa bounces her head positively.

In the story above, the teacher the teacher used props from his adult students’ ordinary life and relied on their active participation. However, what catches the eye is his unassuming attitude when he admits he might have made a mistake towards the student’s observation and the acknowledgment of how Léa managed to evaluate the weighs of the packages.

This same student acknowledges the importance of her every day life being a topic in the classroom and points clearly that the teacher’s approach contributes to her mathematical learning process.

He works.... he works with our every day life, you know. He teaches us math... asking us to take... packages of beans, rice, to teacher fractions. Things which are going to make it easier for us to learn... our learning, which is something from our daily life... then... it makes it easy... and it really does, because when I had to learn it when I was a child, I was twelve or thirteen, I just couldn’t learn it, but the way he taught, it was very easy, you know. Get a 5-kilo bag, divide in, in five of one kilo, it was easy for me, you know. Then, I think that his math is related to our life, to our domestic life... it makes things easier.

The student emphasizes that what makes learning easier does not come from the topics chosen by the teacher, but by his approach which is linked to concret situations, from their reality, and to the same extend acknowledging a level of autonomy in André due to the way he conducts his class.

It is not easier to teach this way, he found a way, a technique to make us learn, because we live it. It does make it easier. Yes, it does. It is way easier to learn fractions with beans, rice, sugar because it is my routine. It is easier than learning with numbers alone without an example...

André is always working under interdisciplinary approach, establishing relations among other areas of knowledge without missing his target, the teaching of mathematics. One day, when he was teaching the different ways to divide a square from a symmetric axis, a student makes this remark, “The geography class has an axis that divides Earth, an imaginary axis.” Immediately, André goes to the board, draws a circle with an axis in the middle, and says that it was the symmetric axis and it was related not only to the idea of balance, but also to the idea of fraction. The teacher applied a piece of information from geography, building his class from another of his

personal didactic characteristics – the permanent link done among the different mathematical subject matters, and in this specific situation, the connection between geometric and arithmetical concepts.

André is aware of his interdisciplinary attitude in the classroom as he points out:

I can draw a bridge between mathematics and geography, science and history. It all feels natural. I can see the link between them without any difficulty.

Although André's classes are always planned to focus on a certain schooling math, his dialogical procedures, looking for contextualized connections among the different subjects, *bring the mathematical concepts into life* (Monteiro, 2004) and make comprehensive in their relations with the varied aspect of their lives. According to Ubiratan D'Ambrosio: "ethnomathematics is rarely detached from other cultural demonstrations, such as art and religion. Ethnomathematics fits within a multicultural and a holistic concept of education" (D'Ambrosio, 2001, p. 44).

Autonomy experience

André is a teacher who exercises his autonomy in the classroom, especially in the groups he deals with young and adult education. He says he feels "freer to handle things there rather than he would in a private institution". He feels like innovating and this freedom gives him a professional fluffiest feeling. He explains it himself:

In young and adult education, routine is scarce. Each daily situation is new and it is at the same time motivating.. they renew themselves, their looks are different, the experiences are different, so we always have a goal, we have the topic to teach, but how is it going to be performed, is related to the expectancies they bring day to day, on that specific day. That is, it is not closed, it is not definite.

This exercise of his autonomy seems to be related to the room André gives his students, the chances he gives them to show their own knowledges. It means that, when respecting his students' knowledges he is also respecting his own as a math teacher.

During André's class, his autonomy exercise comes out in his choice not to use materials such as a didactic book, previous remarks nor even other objects known for their pedagogical usage. We have been able to witness André's creativity when explaining a new concept. Elements such as the chalk box, rubber bands, door hinges, the pen, students' props were easily taken into as teaching resources, if regarded suitable for the class.

The beginning of each class was stressed by a review on the previous class and at its end, the topic to be studied in the coming class was announced, followed by a request of some sort of material, such as news report, packages or even cut outs to be used.

For this teacher, the experience of autonomy in the classroom implies voicing and giving autonomy to his students. It also involves ignoring the compartmentalization

of school subjects in order to broaden the limits of academic math, in a constant exercise of creativity.

VALIDATING KNOWLEDGES IN A DUAL CARRIAGEWAY

This paper has handed the results of a case study of a math teacher who works under an ethnomathematical perspective, analyzing his role as mediator among the different knowledges present in the young and adults' classroom. It has also highlighted the characteristics of an ethnomathematical practice (Santos, 2004); open to dialogues, to the ability to establish multiple relations and the exercise of autonomy.

An ethnomathematical perspective, according to many writers, engages the process of knowledges legitimacy of specific groups, in a way to make visible *invisible* and *frozen* knowledges, specially with groups either in social exclusion situation or subordinated to social, cultural and economical capital (Knijnik, 1996). In other words, an ethnomathematical perspective engages the process of *knowledges legitimacy*. The results of this research have signed that ethnomathematical attitudes in the classroom configures a *dual carriageway* validation. That is, voicing students and their knowledges, André's schooling knowledges (Tardif, 2002) are also being legitimated as well. This hypothesis gets body when he talks about ethnomathematics and its influence over his pedagogical practice.

Maybe I already had a tendency towards an ethnomathematics attitude but I just didn't know it was named that. So, in fact, ethnomathematics didn't show me a new perspective, it wasn't that. It just helped me to *support what I already had in mind* (...) (my own practice) has changed because today I am far more aware of it.

The ideas developed in this article aim at taking ethnomathematics and education relations in terms of teachers' pedagogical practice and teacher development programs into a deeper level, specially the one related to young and adult education.

NOTES

1. The research counted on the participation of a undergraduate research student, Rosana Kelly dos Santos, supported by CNPq (A Brazilian Grant Institution).
2. Most likely for this reason, most of the researches on ethnomathematics have been focusing on specific ethnographic groups (such as indigenous nations, professionals groups in general, among others) who share knowledges, techniques that we can make a parallel with math.
3. Research and study group on ethnomathematics coordinated by the writer of this article.
4. UP stands for *Progression Unit Groups*.
5. EJA – For Educação de Jovens e Adultos (meaning Young and Adults Education, in Portuguese).

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