RURAL PAST MARKS IN MIGRANT YOUNG AND ADULTS´ MATHEMATICAL KNOWLEDGE

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Introduction

This work aims to understand mathematical knowledge building processes of low literate young and adults born in different Brazilian geographic contexts, and how these processes and knowledges are articulated in mathematics learning activities in school classrooms. We have also investigated the mediator role of teacher working with an ethnomathematical perspective, building possible dialogues between these diverse knowledges and school mathematical knowledge.

Item 1 focus migratory movement experienced by adult education students and its consequences in classroom cultural diversity dynamics. Item 2 analyzes countryside learning and teaching multiple processes, looking for theoretical and methodological tools that could elucidate the complexity of knowledge construction built outside school spaces and its connections with adult education classroom routines. Item 3 presents three cases that strongly reveal the influence of rural apprenticeship building processes in young and adult mathematical knowledge.

To close we will make a few statements about dialogs that could possibly be established between rural knowledge building strategies and diverse mathematical knowledge, mediated by adult education teachers with an *ethnomathematical look*.

1. Migration and young and adult education

Here we are going to bring up connections that can be made between political and pedagogical issues in adult education and the migratory movement of people that had their access to school denied during childhood or youth.

Brazilian political policy enterprises in adult education have been intensified from last century's second half on. During the same period the increment of internal migrations can be noticed, marked by rural workers dislocation in search of social and economical insertion (Santos & Silveira, 2003), which produced growth in education demand, specifically in those educational initiatives meant to young and adult students, in urban areas mainly.

Population originally from North and Northeast regions, usually having low educational levels, have migrated to South/Southeast regions looking for better life and work conditions, and settled in urban suburbs.

Migratory movement also includes people moving inside the same area or from one region to another, which is equivalent to more than 5 million people movement, 40% of those having fixed their residence in the Southeast region of Brazil from 1995 to 2000 (IBGE, 2003).

In this perspective, migration in Brazil has become a reality that can be observed in any adult education classroom whose students belong to the working class, where evident social and cultural multiplicity distinguish regions, states and municipal districts, as well as their several component cultural groups. Nightly classrooms constituted truly multicultural mosaics, "where teachers and students experienced their differences in ways of talking, thinking and articulating their migrant

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practices, besides those related to their origin, age and diverse professional experiences". (De Vargas, 2003:115)[3]

This way, before attending school, adult education students have elaborated their knowledges in family interactions, work world, social life, as well as in religious and political groups, having their shared knowledge extended to all aspects of their ways of living. (De Vargas, 1995, 2003). Therefore school presents difficulties to acknowledge students' abilities and to dialog with these knowledges, making students experience a double denial: neither having their specific knowledges nor their particular ways of understanding reality accepted by this institution.

As Cury (2002) states, these youngsters and adults cannot be perceived in a prejudicial and discriminatory way, as they represent expressive cultures of diverse Brazilian regions, based on oral tradition and manifested in folk and religious feasts, in *cordel*[4] literature, among other forms.

As a result, a relevant percentage of adult education students carry marks of their rural past that are manifested in daily practices of night classrooms. Their Migrant condition influence their learning and thinking ways.

2. Countryside teaching and learning processes

This item presents elements for the understanding of countryside teaching and learning processes, generally based on informal education (Dasen, 2004). Built in work and family social practices, rural knowledges are structured within the dynamic of different elaboration processes of practical know-how.

In order to understand how countryside native students elaborate their knowledge and how these are reproduced in a rural context, our study has dealt with two complementary concepts. The first one focus on learner's formation, referred to as *learning by impregnation*. The second one is related to co-participation process present in *legitimated peripheral participation* concept.

To Chamoux (1981) relationship among fellows plays a stressing role in the development and reproduction of know-how. She states that technical know-how refers to the knowledge and skills set that allows simultaneous operational dynamics between tool and raw material, including operative chains development, in order to obtain an outcome close to the initially planned one. It's a gestured and intellectual know-how that was individually engendered, where one can find conscious and unconscious gestures. The tools, the raw material and the operative chain knowledge alone are not enough, the practical know-how is demanded as well.

Practical know-how can be organized in two distinct forms: those incorporated and those from the algorithm domain. In the incorporated one, learning is proceeded by experience, which allows us therefore to affirm that it is dissociated of individuals and groups.

> Those knowledges have as a fundamental feature the fact that they cannot be analyzed and decomposed until the end, since the worker knows how to accomplish his work's inherited tasks, but does not completely realize how he knows. Therefore, incorporated know-how is only transmittable by the act of learning, by the more or less identical reproduction of individuals or groups alongside the work. [5](De Vargas, 2000:101)

Incorporated know-how has thus a human and biological base. On the other hand, in the case of a transmission by algorithms, the knowledge and the doing can be disconnected, the knowledge being thus presented in a non-human support, such as a book, a treaty, a program, an instruction file, a scheme, etc.

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[3] Authors' translation.
[4] A regional type of literature from Northeast of Brazil.
[5] Authors´ translation.

Know-how can be *general* or *private*. They are considered general when transmitted to all, such as in the case of agricultural knowledges, where children can observe family members´ and community's operative chains of particular gestures, both in domestic and agricultural spaces, while private knowledge is transmitted only to certain people.

Chamoux (1981) classifies in two main categories the transmission of incorporated know-how: transmission by impregnation and transmission by coaching. Learning by impregnation presumes both corporal and intellectual training, common to all members of the group, embodying gestures, matter perception forms and language, constitutive elements of group culture. It supposes repetitive observation of different techniques and gesture experience as well. When one of these conditions is not fulfilled, impregnation does not process, and an instructor is needed to transmit know-how.

Another concept that provides an important tool to approach learning constituted as a social practice refers to *legitimated peripheral participation* (LPP) (Lave & Wenger, 1993), which analyzes forms of adhesion and of identity construction, embodying place, acquired practice organization, development, reproduction and social transformation cycles in a community of practice.

A community of practice can be defined by relations established between social world, people that integrate it and activities they exercise. Those relations are constructed through time, in interaction with other communities, based on the participation of a cultural practice that has an imbricated knowledge. Therefore, a community of practice is the one that possesses an incorporated technical know-how, and elaborates its knowledges within rural social space and time. (Bourdieu, 1972)

As we have seen there are multiple ways of analyzing practice apprenticeships, several concepts being needed to approach their complexity. This setting includes young and adult education, which has among its students many people from agricultural milieus, where knowledge construction is rooted in work and family social relations.

3. Rural past marks in migrant young and adults mathematical knowledge: ethnomathematics perspective

This item will provide some examples of rural roots in youngsters and adults mathematical knowledge, based on data taken from previous researches developed in an ethnomathematical perspective (Fantinato, 2003; 2005).

Previous ethnomathematics investigations developed in rural contexts (Knijnik, 1996; Oliveira, 2002, among others) have contributed to enhance the understanding about mathematical knowledge among countryside workers. As a research field related to the diverse cultural forms of understanding/representing/using quantitative and spatial relations, ethomathematics has theoretically been contributing to understand different ways of mathematical reasoning among youngsters and adults, as a result of a cultural background built mainly in professional and domestic contexts, including previous schooling experiences.

The social value of the hegemonic knowledge produces an alienation process that makes adults' particular skills *invisible* (Fasheh, 1991) in the school context, for school education tends to exclude whatever happens outside formal schooling. Therefore, while in adult education classrooms, students tend to adopt practices that result from present or past schooling experiences, which they consider *appropriated* for that context, even though those practices are based on *reminiscences of school mathematics* (Fonseca, 2001) – they show automatisms in a higher level than real apprenticeship procedures. Those students have not been given any chances to show their previous mathematical knowledge inside adult education classrooms.

Nevertheless, besides reminiscences of school mathematics, migrant youngsters and adults from Brazilian rural regions bring to their current schooling experiences elements that refer to their agricultural past. Working at plantation fields during harvest time or stock counting, left marks that, even after a long break, still interfere in the learning processes and in the inner associated values. This

paper will discuss three situations that indicate the rural roots in mathematical knowledge of youngsters and adults living in urban contexts.

3.1 Mental calculation as an identification mark

Mental calculation is recognized as a very common practice among youngsters and adults, but not valued inside school context (Carraher, Carraher & Schliemann, 1989). Youngsters and adults own forms of reasoning, such as the constant use of mental calculation, which diverge from mathematics teaching and learning school procedures. Mathematical writing represents a difficulty during this reentrance to school, mainly because it is not very familiar in peoples´ own ways of solving daily life problems that include numbers or other mathematical concepts. In order to adapt to school context, youngsters and adults frequently create particular strategies, like *the confirmative function of the simultaneous use of different procedures* (Fantinato, 2003, 2004), that consists in the use of a more familiar form of solving the problem to confirm a result found through another procedure, which they feel less assertive. In many situations, mental calculation seems to be used for this confirmative scope.

Besides being an alternative way of solving a mathematical problem, *mind* calculation can represent something else, as shown in Fantinato's statement (2003:145):

> ...we work using our heads! People from the North are more capable than people from the South...People from the South only use machines, calculators, right? In the North they do it mentally, and it works indeed! (Interview with Leandro[6], 09/10/00)

The student proudly associates the use of mental calculation to his home region, interpreting the capacity to ignore the use of the machine as his independence towards modern technologies. In this case, much more than a resource, mental calculation is a cultural value, an *identification mark*. Among migrant youngsters and adults from low income communities, mental calculation becomes, thus, a differential element between *the others* (Southern people, users of modern technologies) and *us* (Northern people, slums inhabitants, with personal traditional knowledge).

Many adult education students have learned to calculate "in the head" during childhood and with an older relative, who, although illiterate, could successfully solve daily problems involving numeric representations. In this case, mental calculation also becomes a cultural mark, due to the way learning process has been accomplished. Leandro talks about his grandfather who taught him to put together "the wholes and the broken parts" and insisted that his grandchildren should make mental calculations, even if they learned written algorithms as well. Another student declares having learned to *calculate by head* with his grandfather and acknowledges that this apprenticeship is by far more useful in his professional activities as a seller:

> My grandfather was good at calculations, he would make every sort of calculation…He taught me to calculate like this… I can't do it with a pencil but I can do it mentally. (Interview with Aluisio, 28/09/00)

Mental calculation apprenticeship with someone older, usually a member of the family, can be supported by the concept of *incorporated know-how, transmitted by a master* (Chamoux, 1981), which item 2 has presented.

Student's valorization of mental calculation can also be related to his migratory past under another aspect. Migration experience teaches that whatever can be kept by memory is portable, that is

[6] Respecting subjects´ wish, we have used fictional names in this work.

to say, even though not many material objects can be carried with oneself, one can carry a kind of knowledge that can be used in any place, such is the case of mental calculation. Pointing out a different group of migrants, such as the Jew, Abramowicz (2002) refers to these *portable characteristics of knowledge*:

> Money was a mobile wealth, like knowledge, with money it was possible to run away and escape with something, like knowledge. During one of his visits to Brazil Félix Guatarri was asked if he knew something desterritorialyzing as capital, and he quickly answered; "the thought".[7] (Abramowicz, 2002:42-43)

Another way to analyze the maintenance of mental calculation procedures, constructed by youngsters and adults in their rural past, is to conceive it as a form of resistance built by this population against technological society that excludes them and practiced as a strategy to conquer one ´s place inside it and not to have one's identity nullified (De Certeau, 1999).

3.2 Informal algorithms in the classroom: the counting by parts

The second example that expresses the presence of rural roots in mathematical knowledge refers to a student ´s personal strategy, whose written record was found in a scrap note that had been used in the classroom (Fantinato, 2003). In this particular record the woman solved a problem involving multiplication, which consisted in the calculation of someone's expenses in groceries[8]. Below, Vania ´s words are used to justify her calculation:

> It's for me... when I'm going to make a calculation that I don't know how to add the way it's suppose to be done...*then I always make those small calculations, to make it bigger later, trying to do it right*...The way I solve it,...the calculation, is easier for me to do. Because sometimes the calculation is a "big one"...And it ´s too much work for me to do the other way, so I prefer to do it my own way, then I add everything and have my own way to find the result... and it is still right. (Vânia)

Vania´s way of setting up the calculation is connected to her particular reasoning style, according to which she should divide the several additions in three calculations. This student broke a multiplication calculation in many smaller adding-up computations, using the *heuristic of repeated grouping*, pointed by Carraher, Carraher & Schliemann (1989). In this kind of technique, multiplication is solved by a succession of succeeding additions.

Vania ´s resolution strategy, or according to her words, making "small calculations", seems to have roots in her agricultural past, when she used to help her father counting "how much corn was spent that day for the seeding, how many cans of twenty liters we have planted that day...how much we were going to plant the following day, how many mint seedling we planted...". There is an indication that this counting was done by parts: matching the student's current written process, as noticed in her words presented below:

> ...we helped him counting and used to tell him: "there is this much". Let ´s suppose, when we collected fifty, "there is fifty, there is twenty-five". And then late in the afternoon the machine would go to some other place in the field...and then there..."ten bags" were harvested... do you get it? This is the way we used to do. (Vânia)

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[7] Authors' translation.

[8] Problem ´s enunciation was about the shopping of 5 kilos of rice at R$ 0,80 each, 3 kilos of beans at R$ 1,50 each and 4 kilos of sugar at R$ 0,60 each.

Despite being a written form, Vania´s strategy has similar characteristics to *oral calculation* (Carraher, Carraher e Schliemann, 1989). Apprenticeships carried out among family agriculture practices have structured oral counting processes of harvesting, that seems to have influenced student´s personal habit of checking her results. Once again these strategies express apprenticeships used in social practices of rural labor.

3.3 Number´s *weight*: sugarcane and grouping base

Work experience in the countryside can also leave marks that determine the way quantities are grouped by youngsters and adults while in night classrooms. The following example was taken from data collected from an ongoing research (Fantinato, 2005) with adult education Mathematics teachers. Below, it is presented the report made by a teacher named André, who teaches in a public school located in Campo Grande, a neighborhood in Rio de Janeiro ´s West Zone, while reviewing the main operations with a fifth grade[9] class:

> Then, I noticed that a lady named Maria was combining both methods of resolution...It was also interesting to observe that she made the counting in groups of five sticks and not in groups of ten... why did she do so? I decided to wait and kept walking around the classroom and without her awareness I stood behind her and confirmed what was intriguing me: she made them differently and yet, right.
>
> I let the other students leave the classroom one after the other, and asked her to stay for a minute so I could talk to her. I asked her if she had understood the way I had done it and for my surprise she said she did, but she preferred her own way, as it was easier I asked her to show me and to explain her method...Maria started telling me that she used to make the subtractions outside division not to confuse herself and that she used to count in groups of five – therefore a ten meant two fives – because this was the way she used to do at sugarcane cut in Goiás[10]...Ah, little sticks were actually cane sheaves! She also told me that they were in groups of five for it was lighter to take them to the truck and then she could calculate her day-wages – two hundred canes = R$ 10,00. (15/03/05)

The situation above refers to several and interesting considerations. We are going to emphasize only some aspects, aware that they hardly represent the richness and the beauty of the live dialog.

First, the teacher's attitude, imbued with *an ethnomathematical look*, drives our attention: his sensitive posture of observer of the particular procedures his students develop to solve the proposed mathematical problems; the respect to the difference perceived between *his* mathematics (as a *representative* of official mathematics in school) and Maria's; his curiosity in learning with *alterity*. André ´s respectful attitude made it possible for her to talk about *her* mathematics rooted in the context of her rural work past experiences, *full of life* (Monteiro, 2004) and feelings.

We can also point out the system chosen by Maria to make the groupings, based on fives and not on tens as teacher and school could expect. This choice made by the student and highly supported by her (after all, it ´s not possible to carry ten sugarcanes at the same time!), reflects *the survival strategies of the rural worker and these experiences impact on mathematical reasoning forms*, even after a long time. Her *migrant* condition rebound on her thinking and learning ways (De Vargas, 2003), that carry marks of a *community of practice* (Lave & Wenger, 1993).

As we have seen, for Maria the number has *weight*, and it is intimately connected to her experience at the sugarcane plantations and attached to know-how by impregnation. Harvest demanded a corporal and intellectual training that was common to all group members and consisted in "gestures,

[9] Classes in Brazilian adult education system can be distributed according to a different nomination. We chose to use the more common way of naming classes ´ serialization.

[10] A Brazilian state.

postures and ways of perception of the objects and the language, constituent elements of the culture of the group" (De Vargas, 2000: 102)[11]. Human body in this case, just like in other cultures (Costa, 1998) is used as a weight measure instrument in worker's labor. Memory of how many cane sheaves her body can hold structures the grouping base which Maria still operates as an adult education student, elaborating her mathematical knowledge.

Ethnomathematics building dialog spaces between diverse mathematical knowledge in young and adult education

In this work we have attempted to reflect on knowledge building processes of migrant adults from Brazilian different rural contexts, trying to grasp how learning processes and knowledges constructed in agricultural labor social practices are articulated in adult education classrooms, aiming at the elaboration of mathematical knowledge.

In adult education, we consider vital for the elaboration of pedagogical proposals to take into account students' conflicts with their original cultures which were raised due to the confrontation with school knowledge.

Dialogic teachers like André play an important role in the unveiling and legitimization of these mathematical knowledges, usually silenced in school context, both as process and as product. The acknowledgement of young and adult students' own strategies can enable the construction of new knowledge (Monteiro, 2004).Therefore, teachers working in an ethnomathematical perspective create in the classroom dialogic spaces between different knowledges, by elaborating pedagogical action proposals that attend students' needs more appropriately, promoting their social inclusion.

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[11] Authors' translation.

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