LANDLESS PEASANTS OF SOUTHERN BRAZIL AND MATHEMATICS EDUCATION: A STUDY OF THREE DIFFERENT LANGUAGE GAMES

Gelsa Knijnik

Universidade do Vale do Rio dos Sinos

This paper aims to discuss issues related to mathematics education and culture. Based in the work developed by the author with the Brazilian Landless Movement, it discusses a theoretical background that can give support to the field of Ethnomathematics. It is rooted in a Post-Modern perspective in its connections with Poststructuralist theorizations – more specifically, those associated with the work of Michel Foucault – and the ideas of the "Later Wittgenstein", which corresponds to his book "Philosophical Investigations". Three different language games, each of them associated with a specific form of life, are shown: a language game belonging to the mathematics of the Landless peasants' form of life, another one which is part of a urban sawmill men's form of life and a third, found at Western Eurocentric school's form of life, even considering that all of them have family resemblances.

INTRODUCTION

This paper[1] aims to discuss issues related to mathematics education and culture, taking as an empirical base for the discussion the work developed by the author with the Brazilian Landless Movement (Knijnik, 2006, 2007). Its theoretical support is rooted in a Post-Modern perspective in its connections with Poststructuralist theorizations – more specifically those associated with the work of Michel Foucault – and the ideas of the "Later Wittgenstein", which corresponds to his book "Philosophical Investigations". According to such theorizations, I have considered that Ethnomathematics may consist of a toolbox[2], which allows analyzing: a) the Eurocentric discourses of academic and school mathematics; b) the effects of truth produced by such discourses; c) issues of difference in mathematics education, considering the centrality of culture and the power relations that institute it; d) the language games that constitutes different mathematics associated to distinct forms of life.

We are facing issues connected to politics of knowledge, to the dispute around the definition of which knowledges are included and which excluded in the schooling processes. This dispute is marked by power-knowledge relations, which ultimately legitimate and are the legitimizer of some discourses, which interdict others, precisely those that are about the knowledges, the rationalities, the values, the beliefs of cultural groups we place in the position of "the others".

One should then ask how a single rationality among other rationalities, for example, the rules by which individuals and cultures deal with space, time and quantification processes – all that which Western civilization associates with the notion of

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mathematics – became a "truth", the only "truth" that could be accepted as mathematics in the school curriculum. What is at stake here is to problematize the sovereignty of Modern rationality, which despises all other rationalities associated with "other" forms of life; the existence of a single mathematics – "the official one" – with its Eurocentric bias and its rules marked by abstraction and formalism. To be more precise, we must say that this "official" mathematics – the academic one – is composed by a set of branches, a set of language games, as shown by Ernest (1991), including all those associated with "pure mathematics" and "applied mathematics". The school mathematics – the traditional set of knowledges taught at school – inherits at least part of the formal and abstract grammar that constitutes academic mathematics, through pedagogical recontextualized processes, in Bernstein's words (1996). In summary, it can be said that the set of language games of academic mathematics, as well as those of school mathematics, offers a "dream of order, regularity, repeatability and control (…) and with it the idea of a "pure", disembodied reason" (Rotman, 1993, p. 194).

THEORETICAL FRAMEWORK

The issues briefly shown above lead us to Ludwig Wittgenstein's ideas presented in his book "Philosophical Investigations" (2004) in which he criticized not only his earlier work (presented in Tractatus) but also "the whole tradition to which it belongs" (Glock, 1996, p. 25), "the foundationist schools, and dwells at length upon knowing as a process in mathematics" (Ernest, 1991, p. 31).

In shaping a new philosophy of mathematics – social constructivism – Ernest refers to Wittgenstein as one of the philosophers who considers knowledge not only as a product, giving "great weight to knowing and the development of knowledge" (*ibidem*, p. 90). He considers that "social constructivism employs a conventionalist justification for mathematical knowledge" (*ibidem*, p. 64), assuming that "the basis of mathematical knowledge is linguistic knowledge, conventions and rules, and language is a social construction" (*ibidem*, p. 42). Ernest argues that his philosophical perspective "assumes a unique natural language" showing that "an alternative (i.e. different) mathematics could result" (*ibidem*, p. 64) as a consequence of this position. Mentioning the work of Alan Bishop as an evidence of different mathematics (*ibidem*, p. 67), Ernest will say that "such evidence of cultural relativism strengthens rather than weakens the case in favour of social constructivism" (*ibidem*, p. 64).

These ideas are strongly connected to the ethnomathematics thinking presented in this paper. In fact, viewing mathematics "not as a body of truths about abstract entities, but as part of human practice" (Glock, 1996, p. 24), the philosopher's work gives us tools for thinking about rationality as forged from social practices of a form of life, which implies considering it as "invention", as "construction" (Condé, 2004, p. 29). Moreover, with the support of the philosopher's ideas – and using the expressions that he coined – one can admit the existence of distinct mathematics – distinct ethnomathematics, in D'Ambrosio words[3]. The basis of this statement can be found

in the argument that these different mathematics – in Wittgenstein's words, different language games – are part of different forms of life, a term conceived by the "Second Wittgenstein" as "stress[ing] the intertwining of culture, world-view and language" (Glock, 1996, p. 124), as "patterns in the weave of our life" Glock (1996, p. 129)).

In Wittgenstein's late work, especially in the new conception of language presented by the philosopher, Condé (1998, 2004) argues about the crucial role of the notion of use:

> In such work, use is directly connected to the concept of meaning (…) the meaning is determined by the use we make of the words in our ordinary language. (…) The meaning of a word is given based on the use we make of it in different situations and contexts. (…) the meaning is determined by the use. (*ibidem*, p. 47)

It is in this sense that this notion of use, according to Wittgenstein, is considered pragmatic, not "essentialist". Meaning is determined by the use of words and such a use obeys rules, which are themselves produced in social practices, constituting language games. As pointed out by Condé (1998, p. 91) "the notion of language games involves not only expressions, but also the activities with which these expressions are linked". Language games are produced based on sets of rules (that are rooted in social practices), each of them constituting a specific grammar. So, the grammar that marks each language game is itself a social institution. Moreover, authors like Spaniol (apud Condé, 1998, p. 110) argue that "the grammar constitutes the logic itself, the grammar is the logic. (…) It is impossible to analyze the logic without considering the language".

From what was briefly explained here it follows that different language games, each of them having by a specific grammar with its own set of rules, constitutes a specific logic. This rationale drives us to admit that there is more than a single language game: there are different language games. Is there some kind of relationship between them? If the answer is positive, how does it operate? The response to these questions is given by the "Second Wittgenstein" through the notion of family resemblances. The philosopher would say (as shown in aphorisms 66 and 67 of Philosophical Investigations) that language games form "a complicated network of similarities overlapping and criss-crossing: sometimes overall similarities, sometimes similarities of detail" (Wittgenstein, 2004, p. 320) and adds:

> I can think of no better expression to characterize these similarities than family resemblances; for the various resemblances between members of a family? Build, features, colour of eyes, gait, temperament, etc. etc overlap and criss-cross in the same way – and I shall say: 'games' form a family.

Operating with the ideas of the "Second Wittgenstein" in the context of the struggle for land in the south of Brazil leads us to assume the existence of three different mathematics: a mathematics produced by a form of life associated with MST peasants, another one produced by a form of life of the urban sawmill men and a

third, produced by a form of life found in the Western Eurocentric school, even considering that all of them have family resemblances.

LANDLESS' LANGUAGE GAME OF *CUBAGEM OF WOOD* AND TWO OTHER LANGUAGE GAMES OF DIFFERENT MATHEMATICS

Cubagem of wood (in Portuguese Cubagem da madeira) – to calculate "how many cubics[4] there are in a truck load" – is a common practice in the Landless' culture. The peasants perform it when it is necessary to build houses or animal shelters in camps and settlements and to purchase or sell planks, i.e., "in our negotiations with the sawmill men", as said one MST member. Throughout my work with MST groups I have realized the importance they give to such language games, which are part of their form of life. In teacher education courses and at settlement schools, particularly, I have found great interest in discussing that practice, constituted by a specific grammar, a specific set of rules.

During my work with that group of students I found that they were expecting me to help them learn more about the grammar that marks the *cubagem of wood'* language game. But it was expected that I also assume another role. In consonance with the Sector of Education pedagogical guidelines they aimed to acquire the school mathematics knowledge – the one called by them "book mathematics". Avoiding a naïve perspective, they were aware of the social importance of such a set of language games and the need to learn its specific grammar as part of their struggle.

Even considering the theoretical difficulties involved in translating language games, it is important to express Roseli's method using the words and the syntax of the school mathematics' language games, which we are more familiar with. I am aware that in doing so some (or maybe most of the) specificities that constitute the Landless' form of life which produced the cubagem of wood language game are suppressed. So, it can be said that Roseli's method became a "hostage" of the school mathematics language game when it is said that "her" method basically involves two steps: the first, to identify, by modelling, a tree trunk with a cylinder whose circumference coincides with that of the middle part of the trunk, and the second, identification, also by modelling the cylinder in a quadrangular prism, whose measure on the side is one fourth of the perimeter of the cylinder base. Thus, Roseli's Method for "cubagem" of wood finds, as trunk volume, the volume of the quadrangular prism whose side of the base was obtained by determining the fourth part of a circumference. This, in turn, corresponds to the cylinder base, obtained by modelling from the initially given tree trunk. Roseli explained "her" method[5] step by step, as she pointed to the different parts of the trunk involved in the process. This narrative triggered the study on cubagem of wood which we developed from then on.

During the discussion of Roseli's method there were students who immediately related its grammar to the one that constitutes the land cubação language game called by the group Jorge's method, which was studied before (Knijnik, 1997). In fact, both

grammars have one rule in common: the identification process which associates a cylinder base (in the case of cubagem of wood) or a quadrilateral (in the case of land cubação) with a square. The relationship established by the group between both language games was an interesting pedagogical issue linked to what Wittgenstein called family resemblances.

This notion of Wittgenstein can be helpful in understanding another language game which emerged in the pedagogical process. At some point in the discussions, a two-student dialogue produced a shift in the debate about Roseli's method.

> Jorge: The measurement process that I know is almost the same [as Roseli's method], except that we measure at the narrow end of the wood.
>
> Ildemar: The point is that the right thing would be to do it in the middle. But the purchasers do not want to buy a piece that will fall away, if they want it for square wood[6] or things like that. They will want a piece that goes from here to there [which goes from one end to the other of the log]. Those chips that are produced will only be for burning.

According to these students, there were urban sawmill men who did not use the "middle of the log" as reference, considering only its narrower end, since they were interested in obtaining whole planks.[7] For this purpose a different rule of calculation was introduced, conforming a specific grammar, which leads to a new language game, different from Roseli's. The sawmill men's method was mentioned by most of the group as being practiced at sawmills in the urban areas close to their communities. We found that we were dealing with a language game which is part of a specific form of life, different from that of the Landless' peasant.

But the pedagogical process was not circumscribed to Roseli' method and to that of the sawmill men. One of the language games that constitutes the "book mathematics" – precisely that linked to the calculation of a pyramid trunk's volume -- with its specific rules was also analyzed. Moreover, the family resemblances of the three language games were emphasized. The work involved studying the modelling process of Roseli's Method and learning mathematical tools such as the relations between a cubic meter and its multiples. In different situations the results of calculating the "amount of wood" obtained by Roseli's method were compared empirically to the volume of the cylinder produced by "her" method, which would correspond to a better approach to the total quantity of wood of the trunk, reckoning not only the part useful to obtain "whole planks". The group also found that the results of Roseli's method minimize those obtained using the cylinder volume. The group showed particular interest in learning "the formulas of book mathematics" connected to the discussion we were holding. In learning how to calculate volumes of the cylinder and rectangular prisms the group was dealing with part of the Western Eurocentric school mathematics' set of language games.[8]

Bringing those three language games into the mathematics class enabled the group to go further in the appropriation of their specific rules and this led them to learn more about the Landless peasant cubagem of wood practiced in their communities. When the family resemblances of those language games were analyzed, the students were able to identify the "remnants" of wood that were produced by Roseli's method, which were even greater when the initial measure of the log circumference was determined at the "narrow end", as considered by the sawmill men's method. So, in this case, the wood not used for making planks could be useful for other purposes and therefore, in given situations, it should also be included in the accountancy of their calculations.

Summing up, it can be said that learning about different mathematics and their family resemblances allowed the peasant students to broaden not only their mathematical world, but also their ways of seeing the complex social relations involved in different forms of life and those different language games associated with them.

SOME CLOSING WORDS

I would like to end saying that the issues I attempted to discuss here are no more than provisional, unmarked by hopes for certainty, in the sense given by Stronach and Maclure (1997). I agree with them when they say that we must recognize and try to work within the necessary failure of methodology's hope for certainty, and its dream of finding an innocent language in which to represent, without exploiting or distorting, the voices and ways of knowing of its subaltern 'subjects'" (*ibidem*, p. 4). The ideas I brought to this paper are inspired by this position.

NOTES

1. The paper is a condensed version of the article "Mathematics education and the Brazilian Landless Movement: three different mathematics in the context of the struggle for social justice" (Knijnik, 2007).

2. In considering the Ethnomathematics' perspective as a theoretical tool-box I am following Gilles Deleuze who argues that "a theory is exactly like a box of tools. It has nothing to do with the signifier. It must be useful. It must function. And not for itself. (...). We don't revise a theory, but construct new ones (...). A theory does not totalize; it is an instrument for multiplication and it also multiplies itself." (Bouchard, 1977, p. 208)

3. In fact, D'Ambrosio (2001) considers that each branch of academic mathematics shapes an ethnomathematics; school mathematics is an ethnomathematics and also the ways in which specific cultural groups – like the Brazilian Landless peasant – deal with numbers, space, measurement, etc are considered different ethnomathematics.

4. The terms "cúbicos" and "cúbicos de madeira" are used in the Brazilian rural areas to mean cubic meters of wood. The term "metros de madeira", in English, "meters of wood", is also used.

5. Several students referred to the use of Roseli's Method in their communities. The so called Roseli's method had already been identified in fieldwork previously performed in the south of

Brazil (Klüsener & Knijnik, 1986) and it was also practiced in the state of Acre, in the north of the country (Mattos, Nepstod & Vieira, 1992).

6. At that time, some students used the expression “square wood” to refer to a wooden plank.

7. Taking into account the remarks made before, concerning the “translation” issues from one language game to another, it could be said that the sawmill men’s method consists of calculating the volume of a quadrangular prism whose height is given by the tree trunk. The quadrangular base, however, different from Roseli’s method, is obtained by the inscription of a square with a maximum side at the log base, considered as a circle.

8. The group questioned the possibility of using the rules they had studied in the context of both Roseli’s method and the sawmill men’s method in other peasant practices. One of the students mentioned that the rules he learned could be used in planning the construction of silos for crop storage, at the time one of the main goals of his comrades to render the settlement economically feasible. In some way, we can say that he is identifying family resemblances, in Wittgenstein's words, between these different language games.

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