

THE VIEWS OF LAY NUMERACY INSTRUCTORS IN A FREIREAN LITERACY PROGRAM

AS CONCEPÇÕES DE PROFESSORES LEIGOS DE NUMERACIA EM UM PROGRAMA FREIREANO DE ALFABETIZAÇÃO

Ana Lúcia Braz Dias
diaslal@cmich.edu

Central Michigan University

Harryson Júnio Lessa Gonçalves
harryson@bio.feis.unesp.br

Universidade Estadual Paulista “Júlio de Mesquita Filho”

ABSTRACT

In this study we examine the view of a group of lay instructors in a non-formal, adult literacy program about what it is to teach mathematics based on a Freirean conception of education. The instructors exhibited great clarity about Freire’s pedagogy and issues about critical or dialectical numeracy that have been raised before in the literature. Some of them pose contradictions, such as a focus in mathematics versus an interdisciplinary approach to education; the interplay between technical competence and political commitment; and using contextualizations of mathematics for a critical reading of the world while at the same time attending to students’ educational aspirations.

Keywords: critical mathematics; dialectical education; Interdisciplinarity; numeracy; Paulo Freire.

RESUMO

Este estudo analisou as concepções de um grupo de instrutores leigos de um programa não-formal de alfabetização de adultos sobre o ensino da matemática baseada em uma concepção freireana de educação. Os instrutores demonstraram clareza sobre pedagogia e as questões de Freire sobre matemática crítica ou dialética consubstanciada na literatura. Alguns deles levantaram contradições, tais como a matemática versus uma abordagem interdisciplinar de educação; a interação entre a competência técnica e compromisso político; a contextualização da matemática visando uma leitura crítica do mundo frente às aspirações educacionais dos alunos.

Palavras-Chaves: matemática crítica; educação dialética, interdisciplinaridade; numeracia; Paulo Freire.

1. Introduction

In this study we examine the view of a group of instructors in a non-formal, adult literacy program about what it is to teach mathematics based on a dialectical, and more specifically, Freirean conception of education.

This study is part of research that employed an action research methodology to understand and act upon a non-formal literacy and numeracy program. The data discussed in this paper were obtained as an initial source of information from the program's instructors, and from them the design of that study was generated. The data were collected through questionnaires, and we revisit them here to discuss how a group of instructors views the application of Paulo Freire's pedagogy to the teaching of mathematics.

2. The Literacy and Numeracy Program

This study was conducted in a non-formal literacy program in Brazil, which we will call the Literacy and Numeracy Program (LNP) – not its real name. The program is based on voluntary work, and is in existence since 1992.

LNP is maintained by a network of volunteers. A smaller group of people, which we will call *instructors*, work at forming *facilitators* who will in turn teach the literacy/numeracy classes. The group of instructors consists of employees of a same financial institution (which supports the program) who are originally from various parts of the country. As part of the logistics of the program, these instructors, who also have various backgrounds, go to different cities and towns to train the volunteers who will be the facilitators and work directly with the adult students.

Literacy centers under the LNP initiative have been formed both in urban and rural areas, in all different regions of Brazil, and in different circumstances, which make the classes too diverse to be described in a homogeneous way.

Whereas the actual literacy classes may be very diverse, the LNP course to train facilitators, the *Curso de Formação de Alfabetizadores* (CFA) follows the same basic structure everywhere and every time it is offered. The curriculum of the CFA was developed in collaboration with faculty in one of the greatest universities in Brazil.

The educational principles that guide LNP are based on Paulo Freire's liberation pedagogy, with elements of Vygotsky's socioconstructivist theory and Emília Ferreiro's psychogenetic theory of literacy learning.

Although the CFA does not focus on teaching methods, it does acquaint prospective facilitators with the methodology of "culture circles" and with methods compatible with a constructivist view of learning. This is done by "practicing what it preaches," that is, by incorporating the format of culture circles in the course and by emphasizing a constructivist posture on the part of the instructors. Reading materials about the methodology of culture circles and constructivist principles are also provided to the prospective facilitators, but not much time is spent reading them during the course. It is expected that the volunteers will truly "learn by doing", beginning at the workshops included in the CFA and later on in the *praxis* of actual literacy classes.

3. A Review of the Literature

3.1. Dialectical Education

In general lines, the contemporary pedagogues who advocate a dialectical basis for education attempt to surpass partialist accounts of education – for example, of education as something taking place only in individual minds, or of education as an essentially social phenomenon – to be able to deal with the contradictory poles of education: individual-society, reflection-action, theory-practice, particular-general (Aranha, 1989). Recognizing the contradictions inherent in education, the educational process is then seen as a dialectical process by which these contradictions are surpassed, originating a synthesis that will, in turn, bring with it other contradictions.

Bearing in mind the difficulties of categorizing and labeling the prolificacy of pedagogical theorizing of the last decades, some of the educational theorists known as *critical*, *radical*, or *progressive* can also be said to conceive of education as dialectical. Indeed, Peter McLaren says of critical educators:

The critical educator endorses theories that are, first and foremost, dialectical; that is, theories which recognize the problems of society as more than simply isolated events (...) in the social structure. Rather, these problems are part of the interactive context between individual and society. The individual, a social actor, both creates and is created by the social universe of which he/she is a part. Neither the individual nor society is given priority in analysis; the two are inextricably interwoven, so that reference to one must by implication mean reference to the other. Dialectical theory attempts to tease out the histories and relations of accepted meanings and appearances, tracing interactions from the context to the part, from the system inward to the event. In this way, critical theory helps us focus simultaneously on both sides of a social contradiction. (McLaren, 1989, p. 166)

Although a dialectical conception of education acknowledges the role of schools as reproductive of social inequalities, it reacts against the reproductivist conception of education, which rules out the possibility of school as an agent for social change.

Perhaps the educator who is most readily labelled “dialectical” is Brazilian pedagogue Paulo Freire. Freire’s work has been very influential in literacy education not only in Brazil, but internationally as well. He has also been the strongest influence in the literacy program in this study.

3.2. Freire’s Pedagogy

In *Pedagogy of the Oppressed*, Paulo Freire makes oppression and its causes the object of reflection by the oppressed: “[F]rom that reflection will come their necessary engagement in the struggle for their liberation. And in the struggles this pedagogy will be made and remade” (Freire, 1990, p. 33). For Freire, learning should be a process of *conscientização*, that is, of learning how to perceive social, political, and economic contradictions, and taking actions to surpass them. Therefore, the *conscientização* of the oppressed should not be understood as mere awareness of the condition of oppression – which the oppressed already have – but a full understanding of the contradiction oppressor-oppressed. *Conscientização* and awareness are not similar concepts, as many believe. Freire points out that, in the initial phases of the education process, although the oppressed are aware that they are downtrodden,

their perception of themselves as oppressed is impaired by their submersion in the reality of oppression. At this level, their perception of themselves as opposites of the oppressor does not yet signify engagement in a struggle to overcome the contradiction; the one pole aspires not to liberation, but to identification with its opposite pole. (...) It is not to become free men that they want agrarian reform, but in order to acquire land and thus become landowners – or, more precisely, bosses over other workers. (Freire, 1990, p. 30)

In the popular movements in which Freire took part in the 1960s, he replaced the format of night classes traditionally offered to adult literacy students with “culture circles”. The debates in the culture circles were done around “generative words” chosen by the group coordinators after a survey of the “vocabulary universe” of the students. Other “generative themes”, such as the anthropological notion of culture and the concept of labor, were commonly discussed in all groups.

Dialectical education in general and Freire’s pedagogy in particular aim at bringing students from naïve consciousness to critical consciousness. One major characteristic of naïve consciousness is that it regards knowledge as “a product of the pure spirit, with no relation to historical and social reality or with an apriorist relation to the world. [N]aïve consciousness believes that] the human spirit in isolation is capable of pursuing and justifying knowledge” (Pinto, 1985, p. 65). For critical consciousness, on the other hand, “knowledge is the product of real, objective, concrete and material existence of humankind in the world” (p. 65). Thus, in the context of dialectical education when we refer to critical thinking, we are referring to reasoning that is:

- Relative: It takes into consideration different viewpoints and understands cultural variations of knowledge;
- Concrete: It does not intend to be *a priori*, but is intentionally tied to the concrete situation of an individual or society;
- Historical: It is aware of and takes into consideration the historicity of context in which it is inserted;
- Global: “[I]t avoids the narrow outlines of partial or ‘focused’ views of reality, and sticks to the comprehension of total reality”. (Freire, 1990, p. 99)

3.3. Views of Mathematics

An important step towards a view of mathematics that is compatible with such view of education has been taken within philosophical studies of mathematics. Imre Lakatos challenged prevailing philosophies of mathematics by linking philosophy to the history of mathematics (Lakatos, 1976). Lakatos’s quasi-empiricism points to the informal nature of mathematics and its evolution by positing that mathematical knowledge grows through interaction among mathematics, through proofs and refutations of those proofs. Thomas Tymoczko espoused the cause of quasi-empiricism and has challenged the notion of “the ideal mathematics” usually considered in the philosophy of mathematics, proposing the notion of “an ideal community of mathematics” as a more appropriate one (Tymoczko, 1986). These views are a considerable advance towards linking mathematics to social and historical realities and away from formalist philosophies, which strip mathematics of any connection to an objective world.

Taking a sociological approach, Sal Restivo built on Marxist and Engelian views of mathematics and extended them by drawing on the works of Spengler, Wittgenstein, Struik, and Lakatos, among others, to propose a materialist sociology of mathematics (Restivo, 1983). Restivo aimed at tying mathematical development to the social, political, and economic organization of the civilizations where it took place. He views the increasing professionalization, bureaucratization and specialization of mathematics as one of the determinants of its gradual closure (Restivo, 1991), and the sustaining of the myth of purity in mathematics as a political strategy in defense of interest of the ruling elite and political leaders (Restivo, 1994). Restivo situated his efforts in the broader project of connecting inquiry to liberatory social relationships. He contended, for example, that

It is more important (...) for people concerned with improving mathematical literacy and mathematical education in general in the interest of a more egalitarian and cooperative society to focus their attention on social arrangements rather than on matters of textbooks, curricula, problem-sets, and high-order pedagogy. (Restivo, 1991, p. 172)

3.4. Initiatives in Mathematics Education

The work of Ubiratan D'Ambrosio has had a special impact on the mathematics education community. His concern with the transplantation of curricula from developed to underdeveloped countries originated the "pedagogical and research program" that he combined under the term "ethnomathematics" (D'Ambrosio, 1985). The ethnomathematics program challenges views common among mathematics educators in many different areas, such as the history of mathematics, its epistemology, and theories of knowledge acquisition and production. With this writing in ethnomathematics, D'Ambrosio has brought forward the recognition of different forms of mathematical practices among different cultural groups, thus emphasizing the fact that mathematics is not acultural, but rather a creation of humans to cope with their environment, that has taken as many forms as there are different environments. He has called for a new historiography of mathematics, one that "instead of building up history on heroes, on visionnaires, on the giants of science and mathematics, which inevitably carries a Eurocentric bias" builds upon "the common individual as the builder of scientific and mathematical knowledge" (D'Ambrosio, 1990, p. 375).

Pais (2011) synthesized the work that has been done in ethnomathematics and contended that it does not restrict its research to the mathematical knowledge of culturally distinct people, or people in their daily activities. For him, it is part of the ethnomathematics program to focus on academic mathematics, through a social, historical, political, and economical analysis of how mathematics has become what it is today.

Acknowledging the fact that critical educators have given much more attention to literacy than to numeracy, Ole Skovsmose made the point that it would be too simple to assume that mathematical literacy has a role similar to that of literacy to play in society. He called us to engage in genuine reflection about the possibilities of mathematics in helping people reorganize their views about social institutions, traditions and possibilities for political action before defending the place of mathematics in the curriculum. Skovsmose's approach to curriculum development has been one of reflection about project which he brings into practice and from which he theorized how close they are to an interpretation of "critical mathemacy" which would parallel that of critical literacy. He started with a thematic approach, where the students acquire competence in three types of knowledge: (1)

mathematical knowledge, “which refers to the competencies we normally describe as mathematical skills”; (2) technological knowledge, “which refers to the ability to apply mathematics and formal methods in pursuing technological aims” and (3) reflective knowledge, “which has to do with the evaluation and general discussion of what is identified as a technological aim, and the social and ethical consequences of pursuing that aim with selected tools” (Skovsmose, 1994, p. 100-101). The contextualization or thematization attempted by Skovsmose and his co-workers sought to meet the following initial conditions: (1) the topic must be well-known to the students, who must be able to describe it in non-mathematical terms; (2) the theme must allow for students to “enter” it at different levels, accepting appropriate development by students with different abilities; (3) the theme must have a value of its own and not degenerate into merely an illustrative introduction to a new piece of mathematical concepts, ideas about systematization or ideas of where and how to use mathematics and develop mathematical skills.

In *The Politics of Mathematics Education*, Stieg Mellin-Olsen argue for “a similar role for mathematics to the one Freire designs for the spoken and written language” (Mellin-Olsen 1987, 207). Mellin-Olsen’s approach was also project-oriented. However, as a distinguishing feature, his interpretation showed great concern with the call for action entailed in Freire’s pedagogy. He professed some dissatisfaction with his own project in the sense that they excluded action.

Mellin-Olsen questioned whether elementary school children could participate in or initiate action or whether the content of the projects was “just making a difficult life-situation even more difficult for the children as they explore it” (1987, p. 211). The project which Mellin-Olsen thought to have gone nearest to having the pupils initiate action concerned the demand, by the children for leisure areas.

We disagree with Mellin-Olsen in that we think we must keep in view the larger political picture, especially when choosing the themes for projects. We do not mean to suggest that local themes are irrelevant but rather to say that their relevance can only be judged in view of that larger context. Although we cannot consider the matter of the social background of the students involved in this project, we do not think that helping them demand leisure areas will contribute to their development as adults with more egalitarian values, although the project may help the children fight for *their own* interests when adults. Without dealing with whether the theme above is relevant from a global perspective and is worth committing to, Mellin-Olsen experienced, in this situation, the dilemma experienced by teachers who have a political commitment and who feel they must be on their students’ side when they press for basic rights.

In working at teacher preparation for “emancipatory” mathematics in Mozambique, Paulus Gerdes adopted two strategies. One of them is to “problematize reality” with the future teachers. He posed problems relevant to Mozambiquean reality and discussed with the teachers not only the mathematics involved in understanding those problems, but also the social, cultural and political issues that may be involved in the context of the problem. For example:

For a certain period, sugar production was going down. Why? Changes in the way of paying the laborers had been introduced: from payment in terms of the number of rows of sugarcane cut down to the number of kilograms of sugarcane. Why? Who

can we explain the economic consequences? How can production be raised? Is mathematics involved? (Gerdes, 1985, p. 16)

Gerdes argued that problematizing reality “leads to consciousness, to awareness of the relevance of mathematics as a tool to understand and transform reality.” (Gerdes, 1985, p. 15)

Knijnik worked in the preparation of lay teachers at a school linked to the Movimento do Sem-Terra (“Landless People’s Movement”) in the state of Rio Grande do Sul, Brazil (Knijnik, 1993; 2012). In her discussion of the relation between folk and erudite knowledge, Knijnik added a sociological dimension to the ethnomathematics perspective by considering the social relations among the groups that produce the knowledge under consideration. She criticized some ethnomathematical approaches which, in the name of cultural relativism, “overglorify” popular forms of mathematics, neglecting the limitations those mathematics practices represent to subordinate groups.

Similarly, Brantlinger (2011) expressed his worry that addressing social inequality merely through curriculum will only reinforce the status quo and may institute a “separate but equal” curriculum for minorities. In a remedial high school setting, Brantlinger (2014) encountered “pervasive and persistent resistance” from some students, who expressed that they wanted to have access to the mathematics curriculum that is socially valued (as opposed to a critical mathematics curriculum). The students resented the inclusion of sociopolitical issues in the curriculum as it was in their view a distraction from their academic aspirations. He agrees with Pais and Valero (2012) on the danger of claiming mathematics to be a solution to problems of economic and political nature.

Decades earlier, Frankenstein had made a thorough examination of how Freire’s epistemology applied to the context of mathematics education (Frankenstein, 1983; Frankenstein and Powell, 1994). Based on this analysis, Frankenstein developed a curriculum that she used with working-class urban adult students in Massachusetts (Frankenstein, 1989; 1995). The curriculum aimed at helping students demystify both mathematics and the structures of society. In her assessment of the level of the students’ class consciousness after the course, she found that they had gained awareness of some specific issues but were far from a more overarching class analysis. Some of the attitudes she encountered were of the kind “Don’t touch the wealthy, but, sure, there should be more equity” (Frankenstein, 1995, p. 184).

Frankenstein had long ago pointed towards the danger in thinking small changes in the curriculum can change deep societal inequalities:

Perhaps we could pick a small project, some consumer/citizen concern we can all agree to pursue throughout the term, setting a realistic goal for change. I question the efficacy of this: In the absence of a unifying liberation struggle, small victories become isolated instances that may support, rather than challenge, the system. (Frankenstein, 1995, p. 185)

With all this in mind, we wanted to examine the praxis of *alfabetizadores* in the LNP. Before we worked directly with these facilitators, we wanted to learn more about the views of those who train them in the CFA course. The data obtained in that initial phase of my study will be presented below.

4. Data Collection

The data presented here were gathered during an in-service meeting of CFA instructors and LNP coordinator. The coordinator of the meeting and the first author thought it would be important to take advantage of the occasion, when instructors from all over the country would be gathered at a same event, to launch the action research project. We sketched out some questions which we wanted to see discussed at the meeting. Since we would not be able to be at the event in person, the coordinator offered to facilitate the discussion of the questions and to pass the written answers on to me. We made final revisions to the questionnaire and wrote a letter of presentation in which we asked the instructors for their consent to participate in the study.

The purpose of the questionnaire was to bring about group reflection, to foster an appreciation of the instructor's views as a group, and to delineate any further action towards improvement. However, during the meeting there was not enough time for the discussion of all the questions as a group. As a result, instructors took the questionnaire home to be answered individually. Instructors returned their answers and respective consent forms to the coordinator, who passed them on to me. Thirteen instructors answered the questionnaire.

4.1. Main Themes in Instructors' Answers to the Questionnaire

The instructors' views, as expressed in the answers to the questionnaire, are all consistent with a dialectical and constructivist view of education. In particular, a great familiarity with Paulo Freire's conception of education was evident in most of the answers. The instructors emphasized the importance of dialogue, of valuing students' knowledge, and bringing students' realities into the culture circles. The following answer combines most of the aspects mentioned at one point or another by the other instructors:

Paulo Freire, among other things, taught us that learning happens through exchange and dialogue, and that for this to occur it is fundamental to respect the lived experiences of the learner. The educational process begins with reflection about the reality of the adults, and only makes sense if it returns to reality to transform it. Thus, this process initiates with the choice of content, which happens through the discussion of issues and challenges brought from the students' daily lives to the classroom. In this same way, in mathematics, we can start by surveying the desires and necessities of the adults in their lives, creating and asking them to create problems, discussion the various ways of solving those problems, registering those ways, symbolizing the concrete, and finally presenting another kind of knowledge, that is, the "official knowledge," as one more possibility or one more tool that can be used. Taking into consideration the various ways of knowing that are brought to the classroom additionally rescues the self-esteem of the learners, since they become aware that they possess and can also produce knowledge. Mathematics is thus portrayed as a creation of humankind in the face of the challenges of the environment. What happens in class is a similar process, not something difficult and useless. What is hoped is that this form of teaching contributes to forming conscious citizens who are better prepared to deal with the challenges of reality. (Katrina)

In their answers to the questionnaire, the instructors referenced both their experience as instructors in the teacher preparation course and as literacy teachers. We found it important

to learn about both kinds of experiences because in practice they are mingled. What the instructors experience as literacy teachers shapes their views about what they experience in the teacher preparation courses, as the following remark illustrates:

As for the Preparation Courses, this is where my situation is even more difficult, because, already being critical in relation to my practice as a literacy teacher, I can visualize the “gaps” in the workshops and I don’t have much room to discuss these flaws. (Sandy)

4.2. Trans-and i\Inter-Disciplinarity

One of the first things that the instructors had to say was that they viewed knowledge as interdisciplinary, or even, transdisciplinary; therefore, a dialectical conception of education includes mathematics as it does any other discipline. Ten of the thirteen respondents made some kind of allusion to the need for interdisciplinary teaching, or for a view of knowledge that is transdisciplinary. At times, the instructors criticized the compartmentalization of knowledge we suggested by talking about a “dialectical *mathematics* education”:

The thought of Prof. Paulo Freire does not take into consideration the specificity of one or another kind of knowledge, especially because one of his basic premises is that, in the dialogical relation, what is most important is working for this knowledge as a process of liberation and humanization. Knowledge is inter, multi, transdisciplinary. Therefore, I do not see Paulo Freire’s theory applied to the teaching of mathematics, but to mathematics as part of globalized knowledge, whose different forms, nuances and particularities... are all present in what the learners already know. (Mohammed)

The kind of education that we advocate is not one which is static or in which the disciplines are separable. There is curricular interpenetration (does this term exist?) in which we approach the students’ reality through the lenses of all forms of knowledge (Portuguese, mathematics, history, sciences, etc.)... I think your questions are extremely centered on the teaching of mathematics, while in our conception of education all disciplines are complementary and important. (Cedric)

In other instances, instructors were only bringing into focus the interdisciplinary character of Freire’s epistemology.

We try to keep students’ realities present throughout mathematics teaching’ in the same way we do in other activities or workshops. A basic principle in the method of Paulo Freire is that it presupposes a globalized view of knowledge, and if we don’t work through culture circles, knowledge is detached from reality and thus, particularized. (Helen).

Paulo Freire says that learners already possess knowledge and that they are the subjects in the systematization of that knowledge, in the process of learning/teaching. It doesn’t matter if this knowledge is linguistic, mathematical, or nautical. (Mark)

Many instructors complained that the practice of mathematics education in the LNP (both the Teacher Preparation Course (CFA) and in the literacy classes) is not as interdisciplinary as they wish it were.

As for the literacy course (I mean, in my experience as a literacy teacher), I would mention my difficulty in working in an interdisciplinary manner, without segmenting the content areas explored: the math time, the reading time, etc. (Katrina)

Generally speaking, the prospective teachers tend to return to traditional methods and experience difficulty in connecting the teaching of mathematics to the reality of the students. They tend to separate their teaching into “disciplines”: Portuguese and mathematics. (Edith)

4.3. Technical Competence vs. Political Commitment

In the instructors’ reflections about what they thought the major problems in mathematics teaching in LNP were, we were surprised at the great number of times they expressed difficulties in what we would call “technical matters”: matters of scope and sequence of content and teaching methods. From my previous experience in the program, what we considered the major difficulty in implementing a dialectical mathematics education was viewing mathematics learning as part of the larger goal of understanding reality and being able to act upon it. In other words, what we thought literacy teachers had been having difficulty with was in using mathematics to help students fully grasp social structures so that they could work towards their transformation. Most difficulties expressed by the instructors referred to the processes of abstraction and generalization of mathematics that followed the contextualized discussions:

I think we should have in the course a more systematized discussion about the introduction of mathematics and the sequences that are possible and most adequate in terms of building the foundations for later developments. For example, why and when should we introduce base ten? Some of these fundamental questions should be totally clarified during the course. (Olaf)

In my opinion, we need more information so that we can all work with some topics that are essential to the content (topics that are related to other disciplines). I would include in the reading materials some texts that could give us a stronger theoretical base. (Jack)

[To improve the course] we would need more in-service courses for the instructors so that they could guide the discussions at the workshops with a more solid conceptual base and deepen the theoretical discussion afterwards. (Katrina)

It is important to point out that the learning of mathematics happens from the debates in the culture circles, but that it is fundamental that teachers be prepared for the work that comes later. (Olaf)

Some of the instructors’ answers highlighted the need for a clear, systematic “teaching guide”, such as when they said their major difficulty was “what to teach, when and how” or “teaching multiplication and division”. Although there were many instances in which the instructors mentioned “technical matters” and thus surprised me, there were many others in which their remarks confirmed my expectations:

In my practice as a literacy teacher, I had difficulty in applying dialectical thought to the teaching of mathematics. Because I had learned via the traditional method, I had difficulty in thinking in a different way and in integrating the political proposal of Paulo Freire with the teaching of mathematics. (Edith)

In other activities, the understanding and the “doing” walk hand in hand. This is so true that they [prospective teachers] are able to conduct the culture circles and to discuss political issues within a constructivist approach. In mathematics they have not reached the same clarity: they don’t explore the content, they don’t make connections, and they end up teaching in a traditional way with a superficial constructivist “cover.” (Jack)

People remain attached to the traditional teaching procedures. We have to know how to work with mathematics in an interdisciplinary mode and from the generative theme. We say a lot, but do not live or experience very much. (Mary)

After our “Pedagogical Meeting” (...), many new horizons were open. For example: we can start with the history of mathematics, then to on to mental math, then to the operations. However, I think we still need to find an approach that considers (problematizes) more the social. (Sandy)

Sometimes difficulties with technical matters were expressed repeatedly throughout a same instructor’s answers to the different questions on the questionnaire, with less emphasis on the social and political aspects of mathematics teaching. Other instructors portrayed a more balanced view, saying that improvement was needed *both* in how to work with mathematics in connection to a generative themes and in conceptual base about the decimal system and operations. This constitutes the recurrence of a theme that has been much debated in the dialectical tradition of education, namely the relationship between the technical competence and the political commitment of educators.

The instructors often attributed the weaknesses of prospective teachers at the workshops to those teachers’ previous formal education. The failure of formal schooling to provide a strong education in mathematics was frequently cited. The anxieties, “traumas” and displeasures most people carry away from their school years were seen by the instructors as givens they had to cope with during the workshops, and as one of the major causes of the problems they faced when pursuing their educational goals. Only one person pointed out that:

The performance [at the different workshops: mathematics or literacy] is very similar. The prospective teachers show, at the workshop, great initial difficulty in working in the mode of culture circles. ... The difference in levels that occur is directly related to their capacity for political understanding of the social reality. (Helen)

This suggests that the problem is not only one of incompetence in mathematics teaching but of a general lack of political understanding of reality, without which a political commitment cannot occur.

4.4. Using Reality to Teach Mathematics Vs. Using Mathematics to Understand Reality

When commenting both on their experience as literacy teachers and on the performance of prospective teachers in the workshops, instructors said that embedding mathematics teaching in the context of the students' lives was one of the easiest and strongest points of practice. Many said that the connection with reality was natural and happened easily:

Mathematics emerges as a necessary tool for the discussion and the "reading" we do of the concrete issues that directly affect the daily lives of the adults and young people who are studying. As such, the need to work with mathematics eventually "blossoms" from the culture circle or even from requests of the group. (Olaf)

A very satisfactory aspect [of the prospective teachers' performance in the workshops] is the effort to work with base on the students' lived experiences and the return to the daily life situations. (Katrina)

Many examples were given of the kind of contextualization to which they were referring: working with themes of the local community market, with the weighing and pricing of garbage among students who sold recycled materials to recycling companies, with the organization of local marketplaces, and, when the currency was changed by the government, converting from the old familiar values to the new ones and vice versa.

There was an attempt from the part of the instructors to critically reflect on the importance of mathematics in the process of liberation, relativizing its place in the curriculum. This may have in fact been caused indirectly by the questionnaire, which put a great deal of emphasis on mathematics. Instructors apparently felt the need to take the focus off of mathematics at some point:

The potential of mathematics learning to transform reality only actualizes itself when integrated with other disciplines. Without this, its accomplishment is reduced. (Mark)

I would not say that mathematics alone or even that education alone can liberate the learner. However, the educational process thought of in an interdisciplinary manner is a necessary condition for the building of a society that is constituted by conscious citizens who take on themselves the responsibility for transforming the reality in which they live. (Katrina)

Naturally, the importance of mathematics in understanding reality was expressed as well:

Mathematics has contributed a great deal to explaining distortions in various systems. However, the form in which it is expressed – histograms, graphics, etc. – makes it more difficult each day for the "masses" to understand it. (Sandy)

The conceptualization of mathematics as a tool to "read the world" is similar to that put forth by Frankenstein (1983): Mathematics is taught to unveil social inequalities and aspects of the socioeconomic system.

Mathematics is part of the life of everyone, especially when we think of wages and access to wealth. The social notion of distribution is a central issue that can and should be explored through mathematics. This and other issues should be explored as

a means of increasing capacity for a reading of the world, which we hope precedes the reading of the word. (Mark)

Mathematics should also help to read the world, to understand it, Mathematics helps a lot when we stimulate comparisons among prices (the same product with different prices), incomes (official minimum wage, wage calculated by DIEESE, salaries of executives, of members of the congress, of TV stars, of sports stars,...), comparisons between increases in prices and decreases in incomes, stability of currency, decreases in inflation, loss of spending power, increasing unemployment (show what statistics do not say), knowing what is done with the city's income (distribution of wealth) and how the money is spent. (...) Mathematics can show us how the data about reality is manipulated in the statistics that come out in the press, can help us in comparing the distribution of wealth at different periods in our history, that is, it can help us read what they try to hide from us. (Mary)

Mainly because we live in a capitalist society, where people are measured by quantifications of their production and by the amount of wealth they have, mathematics is, undoubtedly, a fundamental element for people to relate politically to reality. Mathematics allows people to exercise constant questioning and reflection about the kind of society in which they would like to live. People's liberation includes quantitative reflection about the demands that others impose on them and about the real necessities of human beings. (Helen)

5. Discussion

5.1. Interdisciplinary Teaching

The separation of knowledge into disciplines has long been criticized for its fragmented depiction of reality (D'Ambrosio, 1993, p. 5-6). Habermas has characterized the fragmentation of knowledge as a "functional equivalent" to ideology, which blocks enlightenment, not by means of distorting reality, but by preventing the formation of totalizing forms of consciousness. For Habermas, "[I]n place of 'false consciousness' we today have a 'fragmented consciousness' that blocks enlightenment by the mechanism of reification. (Habermas, 1984, p. 355) He emphasized distortions in communication as a source of societal problems. For him, barriers to communication have been impeding the articulation of everyday knowledge into a totalized form:

In place of the positive task of meeting a certain need for interpretation by ideological means, we have the negative requirement of preventing holistic interpretations from coming into existence. The lifeworld is always constituted in the form of a global knowledge intersubjectively shared by its members: thus, the desired equivalent for no longer available ideologies might simply consist in the fact that the everyday knowledge appearing in totalized form remains diffuse, or at least never attains that level of articulation at which alone knowledge can be accepted as valid according to the standards of cultural modernity. *Everyday consciousness* is robbed of its power to synthesize: it becomes *fragmented*. (Habermas, 1984, p. 355)

Habermas's position has caused some perplexity, because of its resemblance to the thesis of the "end of ideology": "One wonders why Habermas does not see the connection between

ideology and fragmented consciousness” (Larrain, 1994, p. 129). Regardless of its link to ideology (or lack thereof), Habermas’s discussion of how the fragmentation of knowledge has worked to “colonize the lifeworld” is revealing, and helps us connect this issue to the conflicts between academic and popular knowledge:

[T]he differentiation of science, morality, and art, which is characteristic of occidental rationalism, results not only in a growing autonomy for sectors dealt with by specialists, but also in the splitting off of these sectors from a stream of tradition continuing on in everyday practice in a quasi-natural fashion. (...) When stripped of their ideological veils, the imperative of autonomous subsystems make their way into the lifeworld from the outside – like colonial masters coming into a tribal society – and force a process of assimilation upon it. The diffused perspectives of the local culture cannot be sufficiently coordinated to permit the play of the metropolis and the world market to be grasped from the periphery. (Habermas, 1984, p. 355)

The separation of knowledge into disciplines, each of which has its distinct group of specialists, has thus contributed to subordinate everyday consciousness to the standards of expert cultures that develop according to their own logics and that exclude everyday knowledge. According to Habermas, barriers to communication among different cultural groups (which have been identified by Snow, 1959) prevent people from reaching a consensus that could organize action. These problems have been sensed by educators who have attempted to work interdisciplinarily. The “increasing sophistication of the issues raised by interdisciplinary approaches (Paiva, 1994) poses new challenges that educators have not yet been able to meet (this was evident in the context of LNP). The way of developing answers to the demands of interdisciplinary teaching have not been totally agreed upon. If, on the one hand, one can argue that educators must start studying educational processes holistically and in an interdisciplinary manner, on the other hand, difficulties specific to teaching and learning have been both detected and created historically, in the context of education separated according to disciplines. Abraham argues that a subject-based, compartmentalizing discussion of “how the compartment mathematics may be taught in the curriculum with a view to developing critical thinking and conscientization: is justified because “in order to change the current curriculum one must see it for what it is (compartmentalized), and reformulate it” (Abraham, 1982). On this issue, we would like to point out that the workshops in LNP’s course for preparation of facilitators are indeed separated by content area, despite attempts at an interdisciplinary approach. Abraham highlights that “it has often been the case that educational innovators have superficially tried to ignore traditional subject boundaries to form a ‘new’ subject;” this “has failed because this ‘new’ subject is simply seen in terms of its traditional subject content” (p. 15). Apparently, this has been going on in LNP: instructors try to encourage prospective facilitators to teach mathematics in an interdisciplinary manner in their introduction to the workshops. However, due to the separation of workshops into content areas and in the case of mathematics, in to mathematical topics (addition, subtraction, measurement, etc.), facilitators tend to limit themselves to the teaching of the topic emphasized by the theme of particular workshop groups.

This discussion suggests the necessity for both subject-based and interdisciplinary inquiry for further understanding of the ways in which liberatory pedagogies can be actualized.

5.2. Technical Competence and Political Commitment

In dealing with LNP's instructors efforts to train technically competent educators, we must critically examine the notion of technical competence. We should be careful not to fall back into technicist pedagogies, which, in their search for the improvement of educational methods, neglect the political venue in which educational practices occur. On the other hand, consideration of the technical competence of teachers is crucial if we do not want to repeat the failure of many of the well-intentioned but ineffective educational approaches implemented during the 1970s in Brazil, which, in their urge to emancipate students politically, neglected the technical preparation necessary to accomplish that goal.

This alternating emphasis on technical and political aspects of education has been historically a point of debate, so in the following paragraphs we will describe this issue a little further.

Historically, the emphasis on the technicalities of education that characterized the New School movement was bombarded with criticism during the 1960's. The debate at first "sought to combine delivery of academic content and skills and *conscientização*" (Paiva, 1994, p. 32 – my translation). However, as emphasis was increasingly placed on *conscientização*, the teaching and learning of traditional school disciplines was deemphasized. "The concept of popular education lost its traditional content (...) and became a synonym for political education through discussion groups" (p. 32). Evidence of this emphasis on political education, with concomitant deemphasis on the teaching of academic knowledge and skills was found, for example, in a study done by a team of researchers from MEB (*Movimento de Educação de Base*) of their work in the state of Ceará, Brazil (*Movimento de Educação de Base*, 1994). Students interviewed in the study often criticized MEB classes for emphasizing political discussion: "I did not like the MEB school because we only discussed, and I wanted to learn how to read and write. Since I wasn't learning, I decided to drop out" (p. 38 – my translation). The emphasis on the political preparation of both teachers and students often led to a neglect of the technical aspects of teaching, and unprepared teachers many times could not go beyond discussions of the obvious in class. In the case of MEB, evidence of the unsatisfactory results of the program led the team of educators to conclude that:

As we all know, being literate is not only being able to recognize letters, and by combining these letters, being able to distinguish or to memorize words. To be literate is to recognize words in a sentence, and to identify and understand the meaning that they are expressing. (...) The same is true for political education: [It is not effective] when it is not able to add a new understanding or approach to a discussion (MEB, 1994, p. 68)

The polemics generated around technicist pedagogies, on the one hand, and pedagogies that emphasized political education, on the other hand, were often characterized by a dichotomous view of technical competence and political commitment. As Gadotti very well puts it, "[w]e are not competent in general, but we are competent for a social class and not for another" (Gadotti, 1995, p. 14 – my translation). A political point of reference is necessary for judgements of competence of educators. And it is the political commitment of educators that is going to determine the orientation of their efforts towards competence.

5.3 Contextualization of Mathematics Content

In their answers to the questionnaire, the instructors listed many applications and ways in which they tie mathematics to the lives of students, and conversely, interpret real life situations through a mathematical lens. Some of the contextualizations cited were stronger than others in helping the students understand social contradictions. The instructors made it clear that there is a difference between doing a mathematics project with the students' realities as a context and discussing the themes of domination, power, and ideology that are embedded in that context and which are crucial in critical education.

As educators we must be clear on what it is that we are trying to accomplish by bringing the students' reality into perspective. Including students' real life situation in class may serve various purposes. It may be done for cognitive reasons (and the research on "situated cognition" supports this (Lave, 1991); it may be done for purposes of understanding context and transforming it; it may even serve the interests of those who want to maintain that reality unchanged, by omitting discussion about it and acting as if the relations of domination in it were natural and acceptable.

6. Conclusions

The instructors in the LNP exhibited great clarity about what they would like to pass on to facilitators and to adult literacy students. They raised important issues that have been raised before in the literature. Some of them pose contradictions, such as a focus in mathematics (which research in mathematics education entails) versus an interdisciplinary approach to education; the interplay between technical competence and political commitment; and using contextualizations of mathematics for a critical reading of the world, while at the same time attending to students' educational aspirations.

The analysis done here concerns the rhetorical level of the instructor's praxis. How these views are translated into practice was explored in Author (1999). Many other factors influence that praxis, but it is important to acknowledge that at least in the rhetorical level there instructors offer us many insights into a dialectical mathematics education. It is additionally important to point out that these are volunteers with no degree in education, in the great majority, which shows education can have a broader reach, beyond formal classrooms.

7. References

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