MATHEMATICS PROPOSALS FOR ITINERANT SCHOOLS OF PARANÁ IN THE CONTEXT OF THE STRUGGLE FOR AGRARIAN REFORM

PROPOSTAS MATEMÁTICAS DAS ESCOLAS ITINERANTES DO PARANÁ NO CONTEXTO DA LUTA PELA REFORMA AGRÁRIA

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ABSTRACT

This text presents suggestions for the curricular project of the itinerant schools of Paraná, located in camps and settlements of the Movimento dos Trabalhadores Rurais Sem Terra (Landless Workers' Movement - MST), based on complex method, from two portions of reality suggested: "Struggle for Agrarian Reform" and "Food Production". These proposals, which involve not only mathematics, but also Portuguese language, geography and sciences, deal with the issue of social justice, talking about both inequality in access to land and possibilities of expanding food production in a sustainable manner, enabling a reflection on the consequences of those discussions and actions of struggle and resistance.

Keywords: Agrarian Reform; Complex Method; Itinerant Schools; Landless Workers' Movement; Social Justice.

RESUMO

Este texto apresenta propostas de encaminhamentos para o projeto curricular das escolas itinerantes do Paraná, localizadas em acampamentos e assentamentos do Movimento dos Trabalhadores Rurais Sem Terra (MST), baseado em complexos de estudos, a partir de duas porções da realidade por ele sugeridas: “Luta pela Reforma Agrária” e “Produção de alimentos”. Essas propostas, que envolvem, além da Matemática, as disciplinas de Língua Portuguesa, Geografia e Ciências, abordam o tema da justiça social, tratando tanto da desigualdade no acesso à terra quanto de possibilidades de se ampliar a produção de alimentos de uma maneira sustentável, propiciando, com isso, reflexões acerca das consequências dessas discussões e ações de luta e resistência.

Palavras-chave: Complexos de Estudo; Escolas Itinerantes; Justiça Social; Movimento dos Trabalhadores Rurais Sem Terra; Reforma Agrária.

1. Introduction

Social injustice in Brazil has several faces, one of which is inequality in access to land. The Gini index numbers[1] with respect to the land distribution, presented in Table 1, illustrate it.

Table 1 - Gini index of land ownership in Brazil

Year	1967	1972	1978	1992	1998	2000	2006
Gini Index	0.836	0.837	0.854	0.831	0.843	0.802	0.854

Source: Departamento Intersindical de Estatística e Estudos Socioeconômicos (DIEESE); Núcleo de Estudos Agrários e Desenvolvimento Rural; Ministério do Desenvolvimento Agrário (MDA) (2011, p. 34).

The proximity of the index to 0.85 - practically unchanged from 1967 to 2006 - shows how far the country is with regard to land distribution and social justice.

By observing the data presented by the survey DIEESE and MDA conducted, we see that, on the one hand, small farms with less than 10 hectares represent 33.7% of all rural properties in the country, accounting for 1.4% of the total land area. On the other hand, properties with more than 2,000 hectares (large estates) represent only 0.8% of rural properties, notwithstanding covering 42.5% of the area of all Brazilian rural properties (Departamento Intersindical de Estatística e Estudos Socioeconômicos; Núcleo de Estudos Agrários e Desenvolvimento Rural; Ministério do Desenvolvimento Agrário, 2011).

The origins of this unjust concentration of land in the country, according to Stédile (2005), are in Act n. 601, of 18 of September of 1850. It is situated in the context of substituting slave labor for salaried labor, in order to prevent the former slaves from taking possession of Brazilian lands. According to article 1, "acquisitions of vacant lands are prohibited for a title other than purchase"[2] (Brazil, 1850), that is, they would become the private property of those who had income, that is, non-slaves. For Martins (1999, p. 102), "the way slavery ended was, moreover, responsible for the institutionalization of an agrarian right that made impossible, since then, a radical reformulation of our agrarian structure".

Parallel to the concentration of land, there were several disputes over their possession. Bezerra Neto (1999) refers to the colonial period, when indigenous peoples struggled to defend their lands against the *entradas* and *bandeiras* (inland expeditions leading to westward expansion of frontiers of colonial Brazil). The author also points out that the territorial struggles gained momentum in the late nineteenth century in the Canudos (Bahia) region and, later, in Contestado (Santa Catarina), characterizing the first phase of the struggle for land in the country. The second phase, for him, was characterized by violent conflicts in several regions of the country, from 1945 to 1959, whereas the third phase took place with the organization of entities between the years of 1950 and 1964, such as *União dos Lavradores e Trabalhadores Agrícolas do Brasil* (Union of farmers and rural workers of Brazil - ULTAB) in the south and southeast; *Ligas Camponesas*

[1] Indicator of inequality that varies from 0 to 1, the closer to 1, the greater the inequality, and the closer to 0, the smaller the inequality.

[2] All citations were translated from Portuguese into English by the authors.

(Rural workers' leagues), in the northeastern region; and the *Movimento dos Agricultores Sem-Terra* (Landless farmers' movement - Master), in Rio Grande do Sul (Bezerra Neto, 1999, p. 10).

Carneiro and Cioccari (2011) denounce the violence that existed throughout this process, stating that the Brazilian countryside, since colonization, has been a "tragic scene of abuses and murders of rural workers" (p. 25). They also claim that, during the period of the military dictatorship, from 1964 to 1985, the violence against the rural workers intensified.

According to Fernandes (1999), the formation of the *Movimento dos Trabalhadores Rurais Sem Terra* (Landless Rural Workers' Movement - MST) began on September 7, 1979, with the occupation of the Macali settlement in the municipality of Ronda Alta, in the state of Rio Grande do Sul, leading to the creation of the MST in 1984, in Cascavel, in the state of Paraná. Since then, the MST has commanded a large part of the struggle for a more equitable land distribution in the country, which has occurred with occupations demanding that the State expropriated and subsequently distributed land. As Caldart (2012, p. 32) states, this way of acting "tampers with the very social structure of a country marked by large estates (*latifúndios*), a comparative of slavery."

The actions of the MST, however, are not limited to land occupations. Navarro (1997) emphasizes that the pressures for agrarian reform also happen with intense negotiations, marches, public acts, petitions, and debates.

The social movements of the countryside call for an agrarian reform that may substantially alter the distribution of land in the country, questioning the legitimacy of private property in the face of social inequalities. Martins (1999, p. 100) points out that "the struggle for land, from which the struggle for land reform derives, is also a struggle for inclusion, for active, productive, participatory and creative social insertion in society, is a struggle for dignity and respect".

The struggle for agrarian reform is associated with the struggle for changes in living conditions in rural areas. One of them is education. Illiteracy rates reflect the precarious situation in this regard: while in cities the percentage of illiteracy is approximately 8.6%, in rural areas this rate is 23.7%, according to the 2010 Brazilian Census (Instituto Brasileiro de Geografia e Estatística, [2012]).

The state of Paraná, in this context, with its specificities, is not very different from the rest of the country.

According to Sapelli (2013), in 1984 - the year the MST was founded - some 1,700 families participated in occupations throughout the state, mainly in the southwest and west regions of Paraná. In the following years, these occupations intensified and Paraná became one of the states with the greatest number of them throughout the country.

In the 1980s and 1990s, there were numerous conflicts arising from occupations. Many families were evicted from the camps[3], with police violence, arrests and deaths. After intense struggles in 1999 and 2000, the policies of the state of Paraná demobilized the rural workers: there were 125 occupations in 1999, which decreased to 23 in 2000, 7 in 2001, and 7 in 2002 (Marques, 2008).

[3] The terms "camp" (*acampamento*) and "settlement" (*assentamento*) differ: camp occurs when land occupations are made as a way of putting pressure on agrarian reform, and when land is expropriated and destined for agrarian reform, it results in rural settlements.

The occupations resumed in 2003, after the changes in the federal and state governments[4], with expectations that the new political conjuncture would lead to agrarian reform. Sapelli (2013, p. 75) points out, however, that "the advances were small, considering the great mobilization made by the Movement in that period".

It was then, and in that context, that the itinerant schools of the state of Paraná emerge. The goal of the land occupations was to have the agrarian reform implemented. However, with legal interventions or violence from landowners, camps often needed to be disassembled and relocated in other lands. In this way, the camp schools did not have ensured their establishment there, and in those cases, they had to become itinerant.

Until the consolidation of this proposal of itinerant schools, which move along with the camps, school-aged youth had to be enrolled in the schools closest to the camps. However, the campers were not sure that school would provide them with vacancies. In addition to this problem, others, such as the prejudice suffered by the children for being members of the MST and the curriculum unrelated to the issues of agrarian reform, caused the collectives to mobilize for the implementation of schools in the camps.

In the state of Paraná, the process of regularization of itinerant schools began in 2003, when there was an audience with the governor of the state to expose the situation, and 11 meetings more with different departments of the *Secretaria Estadual de Educação* (State Secretariat of Education) to, afterwards, have the issue referred to the *Conselho Estadual de Educação* (State Board of Education) (Sapelli, 2013).

Initially, these schools were considered as "pedagogical experiences" and approved by the State Board of Education's Review 1012, of December 8, 2003, and by Resolution 614 of February 17, 2004, of the State Secretariat of Education.

For organization purposes, a base school was defined aiming to "guarantee the organization of the itinerant schools, being held responsible before the State Secretariat of Education of Paraná, regarding enrollments, transfers, certification, lunch school, revolving fund, and the functional life of educators" (Movimento dos Trabalhadores Rurais Sem Terra, 2008, p. 15). Currently, this base school is *Colégio Estadual Iraci Salete Strozak*, located in Marcos Freire settlement, in the municipality of Rio Bonito do Iguaçu.

Due to the transformations of camps into rural settlements due to land expropriations, many schools were no longer itinerant and became regular schools - linked to municipalities and the state. Also, with the implementation of new occupations, with the creation of new camps, new itinerant schools were created. Currently[5], the itinerant schools of Paraná are as listed in Chart 1.

Chart 1 - Itinerant schools of the state of Paraná

Itinerant school	Camp/Settlement	Municipality
Iraci Salete Strozak (base school)	Marcos Freire	Rio Bonito do Iguaçu/PR
Herdeiros da Luta de Porecatu	Herdeiros da Luta de Porecatu	Porecatu/PR
Paulo Freire	1º de maio	Paula Freitas/PR

[4] In 2002, Lula, from *Partido dos Trabalhadores* (Workers' Party - PT) was elected for the presidency of the Republic, and Roberto Requião, from *Partido do Movimento Democrático Brasileiro* (Brazilian Democratic Movement Party - PMDB), was elected as governor of Paraná.
[5] In August 2017.

Caminhos do Saber	Maila Sabrina	Ortigueira/PR
Valmir Mota de Oliveira	Valmir Mota de Oliveira	Jacarezinho/PR
Carlos Marighella	Elias Gonçalves de Meura	Planaltina/PR
Semeando o Saber	Zilda Arns	Florestópolis/PR
Herdeiros do Saber I, II, III e IV	Herdeiros da Terra	Rio Bonito do Iguaçu/PR
Vagner Lopes	Dom Tomás Balduíno	Quedas do Iguaçu/PR

Source: produced by the authors

These and other schools that were formerly itinerant and have now been established in settlements, follow the curricular guidelines present in the study plan of the itinerant schools (Movimento dos Trabalhadores Rurais Sem Terra, 2013). This document, developed by researchers, educators and the MST education collective, aims to guide the school community with regard to methodological orientations, philosophies and ideals on which the school is based, presenting practical possibilities.

It is important to point out that the study plan is part of a much larger pedagogical proposal that involves cycles of human formation, rather than seriation; evaluations carried out with descriptive reviews, not notes; without failures, but with intermediate classes; organization of work by areas, rather than disciplines (Sapelli, 2013).

The dynamics of the creation of this document, presented by Sapelli (2013), explains the process of living and making choices that curricular proposal involves. What was initially based on Paulo Freire's ideas, especially the generative themes, began being based on Moisey Mikhaylovich Pistrak's studies and practices in the USSR school-commune.

Some ideas in the itinerant schools study plan are inspired in the schools-commune. "Study plan", for example, as presented by Freitas (2009), was the name given to the curricular proposal of those schools - which are "boarding schools that, between 1918 and 1925, turned to the task of solving the practical question of elaborating the new pedagogy and the school of work " (p. 12), after the Soviet revolution of 1917.

In the study plan of those schools, the complex is an articulating concept that plays a central role. In the context of the Soviet revolution, "by complex we must understand the concrete complexity of phenomena, taken from reality and unified around a certain theme or central idea" (Narkompros, 1924, p. 5 apud Freitas, 2009, p.35). Thus, each theme brings together the dimensions of nature, of society, in connection with work, so that, together, they deal with the complexity of that part of reality (Freitas, 2009).

The aim of this proposal, as Freitas (2009, p. 36) explains, is to overcome the "verbalist content of the classical school" and the dichotomy between theory and practice through socially useful work.

Based on this proposal of the schools-commune and with the same names - "study plan" and "complex method" -, the itinerant schools of Paraná propose their curriculum (Movimento dos Trabalhadores Rurais Sem Terra, 2013). From the "portions of reality" that are constantly experienced in the camps and settlements, the material presents some possibilities of complexes that can be worked out by all schools, but they must be adapted according to each schools' specific context and particularities.

The portions of reality, listed each year[6] and semester, are as follows: struggle for agrarian reform; food production; forms of collective organization inside and outside school; rural workers' culture; management of ecosystems; self-government; forms of collective organization inside and outside the school; breeding of animals; agroindustry; organization of camp/settlement and school; production processing; agribusiness (monoculture and cooperative companies or others); and sales/marketing of products (Movimento dos Trabalhadores Rurais Sem Terra, 2013).

In each complex, there are methodological indications justifying the presence of the disciplines. The objectives, contents, prerequisites and expected successes are also listed. Thus, mathematics contents - as well as other disciplines - are always connected with the portions of reality.

We intend, in this work, to present some portions of reality that are suggested to work mathematics contents through the complex method and then discuss which developments may favor those mathematics proposals, insofar as social justice is concerned.

2. Complex method

As we aim to address the portions of reality that are part of the complex method, we will present in more detail what the complex method is, how it was constituted - both in the school-commune and in the itinerant schools of Paraná - and those that served as the basis for the development of the mathematics proposals presented here.

For this, it is important to understand why the complex method has replaced Paulo Freire's generative themes. After all, until the middle of 2010, according to Sapelli (2013), the generative themes had strong present in the itinerant schools of Paraná. It is possible to verify, in the publications of *Cadernos da Escola Itinerante MST* (MST itinerant school notebooks), years 2008 and 2009, the importance of the generative themes in the pedagogical practices of those schools (Andrade, 2008; Farias, 2008; Grein & Gehrke, 2008; Pieri, 2009; Luciano & Viegas, 2009).

One problem pointed out by Sapelli (2013), however, was that the generative themes did not guarantee that all the contents of the several disciplines were addressed. Thus, to ensure the presence of curricular contents, "the curricular guidelines that the State Secretariat of Education/PR was just constructing" were taken as a starting point (Sapelli, 2013, p.240).

> As in the planning work done in the EI [Itinerant Schools], in the period prior to 2010, reference in relation to the contents that should be guaranteed each year was perceived to be lacking, a process to construct lists of contents was started [...]. This served as an initial raw material for the construction of the new proposal and potentialized the work of contents in schools. It was difficult to build such lists, because the educators themselves who worked in the schools found it difficult to define the contents per year. Thus, several experts from different disciplines were involved and several curricula were consulted, causing several modifications to the SEED/PR [State Secretariat of Education] Guidelines. (Sapelli, 2013, p.240)

[6] The study plan published (Movimento dos Trabalhadores Rurais Sem Terra, 2013) is only for *Ensino Fundamental II* (for children aged 11 to 14 years).

Important information regarding that process is that the mathematics contents were inserted after the other disciplines because, according to Hammel, Farias and Sapelli (2015, p. 86), "at first there were no experts in this area to establish connections [between teaching objectives and issues of life] ".

Since the complex method of the itinerant schools of Paraná is inspired by the school-commune, we briefly present how some of these proposals were implemented in the Soviet Union's context.

In the school-commune, as Freitas (2009, p. 37) states, the complex method is an articulating space between current issues, self-management and work, and not just a "theme". In short, regarding current issues, Shulgin (1924 apud Freitas, 2009, p. 23-25) emphasizes that students need to know and experience today's issues of struggles, construction, and contradictions. With regard to self-management, there is the importance of working, living, and building collectively, which depend on the development of organizational habits and skills (Shulgin, 1924, p. 63-64 apud Freitas, 2009, p. 29). By work, we mean the socially useful work. According to Freitas (2009),

> the socially useful work is the connection between the so-spread theory and practice. It is by work that this relationship materializes in a broad sense. Hence the motto: it is not enough to understand the world, it is necessary to transform it. The school is an instrument of struggle in the sense that it allows us to better understand the world (the domain of science and technology) in order to transform it according to the interests of the working class (the countryside and the city) for work. It is not, therefore, any "activity". Moreover, it is not a "theoretical practice" or an illustrative exercise on a given work. School is connected to their environment, *to their contradictions and struggles, which need the contribution of science and technology - not, however, as a mere trainer of "technical cadres"*. [...] As it is required to be *socially useful*, work cannot be limited to the inside of the school. It occurs in social practice, in the social environment, with school understood as *continuity of this environment* and not as a "preparation for this environment"; as a place where the task of knowing this medium is organized - with its contradictions, struggles and challenges. (Freitas, 2009, p. 33-34, author's italics)

Some characteristics of the complex method, in the Soviet experience, from 1923 to 1929, according to Pistrak (1934, p. 120-121 apud Freitas, 2009, p. 44-46), are:

1. "The scheme is designed to overcome the frequent isolation of the knowledge that existed in the old school" [...]. To achieve this, the basic method of studying vital phenomena, through the scheme, becomes the "complex method" [...].
2. Organizationally, this study takes the form of a study of school subjects not isolated from one another, but as "central themes, the elaboration of which gives students all the knowledge and habits they need at a given moment".
3. Isolated disciplines are eliminated in basic school; teaching is built based on the themes of the complexes. [...]
4. In elementary school, the exclusion of specific subjects was conducted relatively easily, because a single teacher taught all disciplines to a class. At the second level, it was impossible to give up completely on specific subjects. In the second level school, several teachers teach the classes, not just one. The complex method, therefore, couldn't be conducted on the second level as it was in the first level. But, giving up the complex method was undesirable; in the opinion of the authors of the programs, it departs, inevitably, from the aspiration of connecting science with life, of studying vital phenomena in all their complexity, as it exists in reality. When the goal becomes not the study of the discipline, but the study of living reality, it is only natural that the boundaries between disciplines become more mobile; that the link

between the disciplines is stronger. [...] The complex method requires collective, united work of all teachers. [...]

5. Each subject of the second level of the school, in turn, was built by the same system of complexes. The theme of a given subject was formulated based on the general theme of the complex; according to this theme, the material was divided into a series of steps, the first of which was the "material of production". [...] In this way, they tried to solve the task of the immediate connection of school subjects with the study of the working activity of the people, also with the participation of the children in the productive work [...].

Pistrak (1934 apud Freitas, 2009) evaluates this period and indicates some errors in the proposition and implantation of the complex method. For him, a basic mistake was to "oppose the study of separate school subjects to the study of living reality," since, according to him, "one should study life and reality not outside disciplines, but through school disciplines" (Pistrak, 1934 apud Freitas, 2009, p. 47). He goes on to say that

> the denial of the system of materials, of the autonomy of the disciplines, the subordination of the material of each discipline to the themes of the complex external to each discipline and occasional for it, led to the transgression of the systematicity of the subject matters. (Pistrak, 1934 apud Freitas, 2009, p. 48)

However, Pistrak further states that "by sacrificing the systematicity of school subjects, their autonomy, by sacrificing the system of disciplines in the name of complexity, programs have not solved the task of complexity satisfactorily as well" (Pistrak, 1934 apud Freitas, 2009, p. 48). He understands that "the subjects of the complex were studied statically, descriptively, formally, without understanding the dynamics of the phenomena development," and thus "the students became superficially familiar with what exists, but not with their origin, how it develops, where it goes, what it is" (Pistrak, 1934 apud Freitas, 2009, p. 48).

After this period (from 1917 to 1929), there were, according to Freitas (2009), two important reforms. The first one, in 1930, adopted a method called complex-projects (system of project-based learning) in schools, from the ideas of the school elimination theory; and the second, in 1931 and 1932, as a counterpoint to the first, resumed "the classical form of school work organization" (Freitas, 2009, p. 65).

This history of the complex method in the Soviet Union, with its proposals, reformulations and criticisms, shows us how was the elaboration of the study plan for the itinerant schools of Paraná. It is significant that Luiz Carlos de Freitas, who translated Pistrak's book "The School-Commune" from Russian into Portuguese, and analyzed the work in which Pistrak, in 1934, evaluates the experience, was one of the proponents, along with Roseli Salete Caldart, to work with complex method in MST schools.

As Sapelli (2013, p. 241) states,

> Early in the work, Freitas indicated that experimentation with complex method did not represent the transposition of the Russian experience, but that it would be a starting point. Several adjustments were made in the process of constructing the study plan from Pistrak's self-criticism and from reflections made by the collective that worked on this process.

Also, we understand that the "mistakes" indicated by Pistrak can help us elaborate the mathematics proposals for the itinerant schools, from the complex method existing in the study plan (Movimento dos Trabalhadores Rurais Sem Terra, 2013).

The preparation of the study plan by the MST begins in 2010, as a result of reflections and evaluation of proposals in progress since the 1980s, with the *Pedagogia do Movimento* (Pedagogy of Movement) (Caldart, 2012). As Hammel, Farias and Sapelli (2015, p. 68) put it, "not only the need to potentiate what was in process was pointed out, but also to include new elements to advance in the construction of a new education and new content for the working class".

The first stage of this process covered "both the survey of the social conditions surrounding the schools in question, that is, the construction of inventories, and the formulation of the list of contents, the conception of education, the formative matrix, the formative and teaching goals" (Hammel, Farias & Sapelli, 2015, p.73). In the second phase, of analysis and establishment of relations between the elements of the study plan, the participation of Luiz Carlos de Freitas was fundamental, because of his research works on the Soviet experience with the complex method. The third and final phase of this material elaboration period focused on the organization and systematization of what had been done in the previous phases. This involved the task of "arriving at the questions of reality, therefore, of the present time, which would be another element to compose each complex. These issues of reality were named as portions of reality/categories of practice" (Hammel, Farias & Sapelli, 2015, p.87). In addition, in this phase, methodologies of work with the complexes, forms of assessment and relations with the reality, as well as aspects of the school management were discussed.

To present our proposal, we have chosen two complexes suggested for the second semester of the 7th year of elementary school - three in total - that involve the following portions of reality: "struggle for agrarian reform" and "food production".

In the following sections, we present proposals to approach these complexes, contemplating - not only, but especially - mathematics considering the other disciplines involved, so that we can discuss which developments may favor social justice.

3. Complex 1 proposal: from the portion of reality "struggle for agrarian reform"

Complex 1, organized from the portion of reality "struggle for agrarian reform", is thus presented:

> This complex was organized from the category of practice/portion of local reality or the environment in which we plan to anchor the study: struggle for agrarian reform and in which specific struggles unfold in the school environment - struggle for land, for infrastructure in the areas, production conditions, agroecology, education, health, ...; involvement of families in the struggles, specific involvement of youth; mobilization or journeys of struggle planned for the period and their disposal in the territory; production of materials for mobilizations; discussions that exist in the camp (or settlement) about school and, especially, students' participation. (Movimento dos Trabalhadores Rurais Sem Terra, 2013, p. 134)

The subjects involved in this complex are: Portuguese language, physical education, geography, history and mathematics. The justification for the presence of mathematics is presented as follows:

> To use percentage calculation to understand the situational advances of agrarian reform and agribusiness in Brazil. To verify the possibilities of new advances in relation to the struggle for the agrarian reform when perceiving the very high rates of estates and monocultures. (Movimento dos Trabalhadores Rurais Sem Terra, 2013, p. 145)

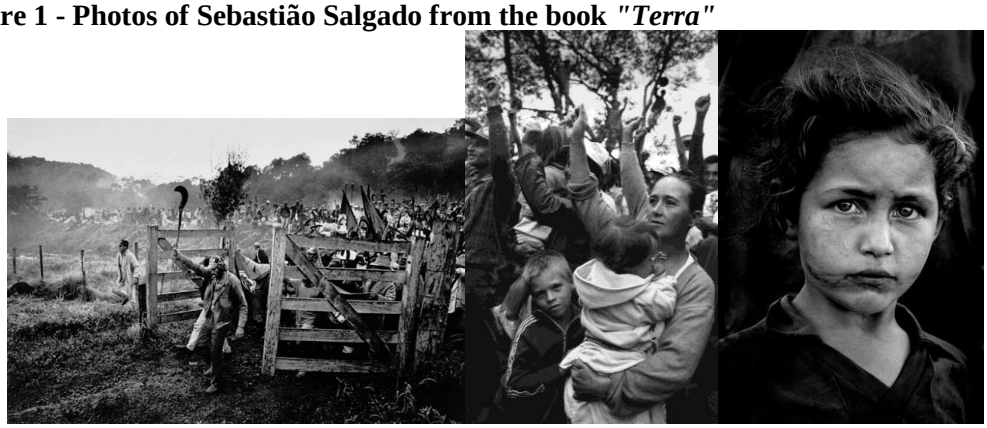
In this way, we present a proposal of approach that contemplates some mathematics topics and Portuguese language and geography, without exhausting the complex. We explain which contents, teaching objectives, training objectives and justification extracted from the study plan relate to the proposal throughout its presentation.

As a starting point, we recommend a study about the book *"Terra"* (Land), by photographer Sebastião Salgado, released in 1997. He presents one section of the book, *"A luta pela terra"* (Struggle for land), in the following way:

> There are tens of thousands of Brazilian families living in roadside camps in various parts of the country. They are landless families that gradually join and form true cities, sometimes with a population of more than 10 thousand inhabitants.
> The conditions of life are the most rudimentary; everything is lacking: water, food, sanitary facilities, school for children, medical assistance, etc. In addition, those people live in great insecurity, subject to provocations and violence by the *"jagunços"* [hired thugs] and other forces of repression organized by the landowners, who fear the occupation of their unproductive properties. [...]
> Nevertheless, the ones that were disinherited of the land nourish the hope for better days. And one thing is certain: they no longer want to flee to the cities, which can no longer absorb them, give them work and decent living conditions. They prefer, therefore, to guard against the threats of delinquency and prostitution of the great urban centers, to remain in the camps along the roads and to wait for the opportunity to occupy the so dreamed land, even at the risk of life. Their projects are identical: to, finally, cultivate their piece of land, to build a house for the family, to ensure their livelihood and, through the cooperative to be created, to market the surpluses of their agricultural production, guaranteeing the maintenance of school for their children. This is, in short, the dream of the landless. (Salgado, 1997, p. 141-142)

This section presents several photos of MST occupations in various regions of the country. Many, like those in Figure 1, were taken in the state of Paraná.

Figure 1 - Photos of Sebastião Salgado from the book *"Terra"*



Source: Salgado (1997)

The book also has a preface written by José Saramago and songs by Chico Buarque. The reading of those verbal and nonverbal texts covers the theme "discursive genres", proposed for Portuguese language. As expected goals, the study plan states:

> When reading, the students seek to know what the source is, when and where the text was written, under what conditions, and seek to identify the intentions implicit in the written

> texts. They are able to differentiate between texts in different textual genres, realizing that we use reading strategies for each of them. They seek to read beyond what is explicit, bringing to the texts they read their experiences and other readings. (Movimento dos Trabalhadores Rurais Sem Terra, 2013, p. 135)

Thus, by reading different discursive genres existing in the work, students can discuss about the authors, the languages they use, and what brings them closer. It is possible for students to be introduced to these authors through other works, such documentaries, music, and other books. Teachers will also be able to discuss the relationship between the book *"Terra"* and the construction of the *Escola Nacional Florestan Fernandes*, of the MST, located in Guararema-SP. One suggestion of reading in this respect is of another discursive genre, the journalistic genre, in the MST site, which brings the history of the creation of that school and how the profits of the sale of Sebastião Salgado's book contributed to that[7].

Photo captions can serve as a basis for the discussion to connect with other topics. The first photo in Figure 1, for example, brings some impressive numbers in its caption:

> By the way things were going, it was not difficult to imagine that the final destination was Giacometti farm, one of the immense estates, so typical of Brazil. Although marginally exploited, those estates, because of their colossal dimensions, assure their owners millionaire incomes. If properly used, the 83,000 hectares of the Giacometti farm could provide a dignified life to the 12,000 beings who marched at that moment towards it. (Salgado 1997, p. 143)

The presence of huge estates in the country, as opposed to the absence of land of the so-called "landless", can be studied under different perspectives. One of them is geography, addressing the "land structure and social movements of the countryside" (Movimento dos Trabalhadores Rurais Sem Terra, 2013, p. 139), aiming "to begin the understanding of the process of formation of agricultural frontiers and the land structure in the country" (p. 138). As one of the expected successes, is that "the student should consider, when reading the geographic space, in particular, those of the camp and settlement of agrarian reform, that certain phenomena are the result of the concentration of land in the country" (p. 138/139).

For that, mathematics can help by treating the information, as suggested by the study plan.

An important material for that study is the book *"Estatísticas do Meio Rural 2010-2011"* (Rural Area Statistics 2010-2011), produced by DIEESE and MDA (2011). Regarding Gini index, already presented in this text, it is possible to approach the values that refer to the region of the country in which the school is inserted. In Table 2, we highlight the south region of Brazil:

Table 2 - Gini index of land ownership in the south region of Brazil

Year	1967	1972	1978	1992	1998	2000
Gini Index	0.722	0.706	0.701	0.705	0.712	0.707

Source: Departamento Intersindical de Estatística e Estudos Socioeconômicos; Núcleo de Estudos Agrários e Desenvolvimento Rural; Ministério do Desenvolvimento Agrário (2011, p. 34).

[7] Suggested reading: http://www.mst.org.br/2015/07/17/dez-anos-de-enff-um-sonho-construido-a-muitas-maos.html.

Another interesting material for this work is the report *"Terrenos da desigualdade: terra, agricultura e desigualdades no Brasil rural"* (Land inequality: land, agriculture and inequalities in rural Brazil) (Oxfam Brasil, 2016). This document presents the Gini index of each state of the federation. It is possible to see the evolution of values in the state of Paraná, as shown in Table 3:

Table 3 - Gini index of land ownership in the state of Paraná

Year	1985	1995	2006
Gini Index	0.749	0.741	0.770

Source: Oxfam Brazil (2016, p.9)

In addition to exploring how the organization and the reading of the data in the tables is carried out, it is possible to propose a discussion about the Gini index:

(i) as to the decimal values: understanding the decimal representation of a rational number, ordering those numbers, determining which numbers are larger and which are smaller, perception that they are between the integer values of 0 and 1;
(ii) as for the Gini index itself: meaning of values, relationship between numbers and land concentration, minimum and maximum values, and comparison between periods or between regions or between countries.

It is important to observe that the discussions in (i) and (ii) are complementary. For example, the Gini index values are always decimals between 0 and 1 and it is not possible, by the index definition itself, that they are outside this range. Also, as the number 0.770, or 0.77, is greater than 0.749, the concentration of land in the state of Paraná was stronger in 2006, when compared to 1985.

Concomitant to this discussion with the values of the Gini index, it is possible to deal with the land structure, with information present in Table 4:

Table 4 - Land structure in Brazil in 2009

Strata of total area (ha)	**Property**		**Total area**		**Average area (in ha)**
	Number of properties	**In %**	**In ha**	**In %**	
Up to 10	1,744,540	33.7	8,215,337	1.4	4.7
From 10 to 25	1,316,237	25.4	21,345,232	3.7	16.2
From 25 to 50	814,138	15.7	28,563,707	5.0	35.1
From 50 to 100	578,783	11.2	40,096,597	7.0	69.3
From 100 to 500	563,346	10.9	116,156,530	20.3	206.2
From 500 to 1,000	85,305	1.6	59,299,370	10.4	695.1
From 1,000 to 2,000	40,046	0.8	55,269,002	9.7	1,380.1
Over 2,000	39,250	0.8	242,795,145	42.5	6,185.9
Total	**5,181,645**	**100.0**	**571,740,919**	**100.0**	**110.3**

Source: Departamento Intersindical de Estatística e Estudos Socioeconômicos; Núcleo de Estudos Agrários e Desenvolvimento Rural; Ministério do Desenvolvimento Agrário (2011, p. 30).

The data presented in Table 4 show that more than half of the total land area in Brazil (more specifically, 52.2%) represents only 1.6% of rural properties. This information is

potential for the discussion about the concentration of land in the country and, for this, it is important to understand what the percentages represent.

The different representations of the rational number - fractional, decimal and percentage - are mixed in these values. Understanding that 52.2% means a little more than half is important to understand what is said about rural properties and also to understand the for the extent of land concentration.

It is also important here that students know how to operate with percentages and understand what the results mean. For example, the 52.2% value was obtained by adding 9.7% and 42.5%, of the percentages related to the total area of properties with an area of 1,000 to 2,000 hectares and over 2,000 hectares, respectively. Likewise, 1.6% resulted from the sum of 0.8% and 0.8%, which represent the number of properties with those same areas. Besides knowing how to perform the addition operation, it is essential to understanding which values can be added to obtain relevant information and make sense. It would not make sense, in this case, to add 9.7% and 0.8%, since they refer to different information. Still, the sum of 9.7% and 42.5%, as it results in a value greater than 50%, is relevant, in this case, to communicate and cause impact.

Another suggestion to approach the topic "information processing", after all these discussions, is the presentation of different types of graphs and interesting forms of representing the same information present in the tables, but with a graphic language. For example, the report *"Terrenos da desigualdade: terra, agricultura e desigualdades no Brasil rural"* (Land inequality: land, agriculture and inequalities in rural Brazil) (Oxfam Brazil, 2016) presents several graphs using figures and colors that can foster this discussion.

With these many ideas of activities, it is possible to achieve, partially or fully, some formative objectives listed in the study plan, such as:

> 1. To exercise oral and written expression. 2. Use concepts to understand questions of reality. 3. Formulate simple concepts from phenomena of reality. 4. Exercise logical reasoning. 5. Demonstrate intellectual curiosity. 6. Develop capacity for observation of reality and perception of life problems. [...] 9. Know how to analyze and compose (mental and written) syntheses. [...] 18. Know the forms of organization of production and work in the field, including the current counterpoint of logics between agribusiness and rural population's agriculture, and its relation with the social struggles of today's rural workers' social movements. [...] 23. Develop aesthetic sensibility, creativity and artistic expression ability. 24. Denaturalize oppressive relations, demonstrating awareness and indignation at injustices and situations of exploitation between humans and nature. [...] 27. Establish/perceive relationships between teaching content, practical activities and current reality issues. [...]. (Movimento dos Trabalhadores Rurais Sem Terra, 2013, p. 132–134)

4. Complex 2 proposal: from the portion of reality "food production"

Complex 2, organized from the reality portion "food production", is presented in the study plan as follows:

> This complex was organized from the category of practice/portion of local or environment reality in which we plan to anchor the study: food production. The production of food is carried out through agriculture, the word agriculture means cultivated field. The practice of agriculture involves soil preparation, seed management, planting techniques, crop management, and harvesting. To problematize the processes of production and distribution of food, in the perspective of equal access to them, as well as

> the consequences of the different ways of producing them and the positioning of the institutions/organizations that produce them. This means to say that today food production shows the clash of different world perspectives and ways of producing lives: agribusiness and rural population's culture. (Movimento dos Trabalhadores Rurais Sem Terra, 2013, p. 136-147)

The subjects involved in this complex are Portuguese language, Spanish language, arts, physical education, geography, sciences and mathematics. The justification for the presence of mathematics is thus presented: "In relation to food production, mathematics contributes to the measurement of data and calculations to evaluate planned production planning using scales, angles measurements and percentage" (Movimento dos Trabalhadores Rurais Sem Terra, 2013, p.156).

In this way, we present an approach proposal that contemplates some topics, also, of Portuguese language, geography and sciences, without exhausting the complex. We explain which contents, teaching objectives, training objectives and justification extracted from the study plan relate to the proposal throughout its presentation.

As a starting point, to work with this complex, we propose a study on the construction of a "mandala vegetable garden", a food production system in which vegetable planting is done in the form of concentric circles, with each circle destined for a certain type of crop, so that the plurality between the species involved resembles the disposition found in nature, leading to a greater production and less use of biofertilizers and compounds that aim to ward off pests, since each species of plant is thought of as contributing to the protection of the other.

The proposal to work with the mandala vegetable garden, both in school context and in the context of settlements, is not new. Drosdoski, Pereira and Bueno (2014) investigated the practice of mandala vegetable garden as an instrument to promote environmental awareness in children from grades 4 to 8 of elementary school at a school in the city of Porto União-SC. Another experiment is the project *"Horta Mandala: Mãos na Terra"* (Mandala Vegetable Garden: Hands on Earth), developed by teacher Sinara Adriana Soares, in the city of São Mateus Do Sul-PR, between 2009 and 2011. This project was one of the winners in the 5th edition of the *Prêmio Professores do Brasil*[8]. In the context of settlements, Souza (2014) analyzed the development of the mandala system with the rural producers of the Acauã settlement, in the city of Aparecida-PB.

The beginning of the work with the mandala vegetable garden in the classroom may involve questions and research on whether or not to use this strategy in their camps or settlements or other strategies and knowledge related to food production, which are often passed from generation to generation among their families, as suggested in the study plan. In rescuing the knowledge of family members about their ways of producing food, we work on aspects of orality, one of the goals set for the discipline of Portuguese language (Movimento dos Trabalhadores Rurais Sem Terra, 2013, p. 148-149). In this sense, the teacher can promote the participation of the community in the school, inviting parents of the students that present strategies of food production so that everyone can know and problematize them.

[8] *Prêmio Professores do Brasil* (Brazil teachers' award) is an initiative of the Ministry of Education, together with partner institutions, which seeks to recognize, publicize and reward the work of public school teachers who contribute to the improvement of teaching and learning processes developed in classrooms.

Along with this, the teacher can propose to read some of the texts referring to the three experiences mentioned above, allowing the students to carry out readings "that contain knowledge transmitted in texts of a scientific nature" (Movimento dos Trabalhadores Rurais Sem Terra, 2013, p. 147), associating that knowledge with the knowledge of their family members. The students can, after having contact with other experiences, resume the conversation with their families and discuss aspects brought in the texts, questioning the feasibility of implementing the mandala garden, the difficulties and benefits of this planting strategy.

In the context of the Portuguese language discipline, the teacher can foster the differences between the spoken language and the written language, comparing the discourse presented by the family members and the scientific text. This analysis points to the approach to the concept of orality: "appropriateness to the context, appropriateness to genre, differences between oral and written [texts], extralinguistic elements, purposes, linguistic marks, role of the interlocutor, linguistic variation" (Movimento dos Trabalhadores Rurais Sem Terra, 2013, p.149)

Another possibility is, for example, from the work of Souza (2014), carried out in the state of Paraíba, a very different context from the state of Paraná, where the itinerant schools are located, to suggest that students explore geographical and economic differences between these contexts and problematize some implications of these differences in the implementation of the mandala vegetable garden in their camp or settlement. In this way, in addition to working orality and reading, planned for the Portuguese language discipline, students can discuss aspects related to the subject of geography, raising questions about

> the influence of natural phenomena on family and community production, as well as connect the study on the different economic activities developed within the community with activities that are promoted in other parts of the state and Brazil. (Movimento dos Trabalhadores Rurais Sem Terra, 2013, p. 152)

In the context of this discussion, it was possible to deepen the debate about the factors that led the settlement investigated by Souza (2014) to abandon the mandala garden, especially water scarcity. Would this be a problem faced by the settlement if the vegetable garden were implemented in the state of Paraná? Would there be other problems, such as excess of water? And in winter production, which plants should be used respecting the local climate?

There is not only one way to design a mandala vegetable garden. Initially, as suggested by students of the Federal University of Pernambuco, the mandala vegetable garden was designed with nine beds (circular rings) and, in the center of the beds, a reservoir of water that may or may not have fish (Martins & Queiroz, 2017). However, one can think of a mandala vegetable garden that, instead of a water reservoir, has a chicken coop in the center. Figure 2 shows the two types of mandala vegetable garden.

Figure 2 - Mandala vegetable gardens

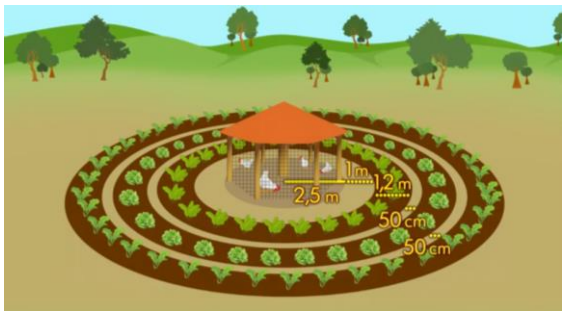
Source: The photograph on the left was taken from the blog of project *Mão na Terra*[9], and the photograph on the right was taken from the site *Brasil Cidadão*[10]

This adaptation to a chicken coop was made for the project called *Produção Agroecológica Integrada e Sustentável* (Integrated and Sustainable Agroecological Production - PAIS). In this system, the coop, besides producing eggs and expanding the variety of products in that small space, serves to generate fertilizer to the vegetable garden. This, in turn, is a source of food for the chickens, since the vegetables that are less propitious for commercialization are destined to the coop. The vegetables that are left in the coop and mixed with the waste of the chickens (the act of mixing manure and the leftover food is done by the chickens themselves, by their scratching the ground) transform the organic matter into organic fertilizer, called composting (Martins & Queiroz, 2017). The study of composting can fit into a content of the subject of sciences, which provides "agroecology - principles of the transformation of energy: food chain, autotrophs, heterotrophs, photosynthesis" (Movimento dos Trabalhadores Rurais Sem Terra, 2013, p. 156).

In the case of mathematics, several contents foreseen in the study plan can be approached through the mandala vegetable garden. Starting with the format of the garden, which enables a discussion about the concepts of circle, ring, and circumference. For the process of construction of the mandala vegetable garden, when defining the center of the garden with a central wooden trunk (buttress) that will support the chicken coop, it is possible to begin the demarcation of the other components of the garden - fence for the coop and the beds. To demarcate the chicken coop, other support struts are placed at the same distance, for example, 2.5 meters away from the central buttress. The beginning of the first vegetable garden may be 3.5 meters away from the central buttress, and the end of this bed will be, for example, 4.7 meters away; that is, the bed will be 1.2 meter wide. The end of the first bed and the beginning of the second may be 50 centimeters away from each other for people to move. Figure 3 illustrates this project:

Figure 3 - Construction of the mandala vegetable garden

[9] Available in http://maonaterra.blogspot.com.br. Accessed in December/2017.
[10] Available in http://www.brasilcidadao.org.br. Accessed in December/2017.



Source: Martins & Queiroz (2017)

Through this process of demarcating the elements constituting the mandala vegetable garden with a chicken coop in the center, it is possible to discuss the concept of circumference, as a set of points equidistant from a point called the center; the concept of circle, as a flat region delimited by a circumference; and the concept of circular ring, as a region delimited by two concentric circles (that is, each bed is a circular ring).

One of the advantages of the mandala garden is that it is possible to walk on the beds so that for any position on the same bed, the distance to the chicken coop is always the same (definition of circumference). This property can be problematized in case the garden is rectangular, comparing the geometric (rectangular and circular) figures and presenting the concepts of edge and vertex. In this case, the plane geometry content can be worked.

Still, with the construction process of the chicken coop, the beds and the distances between them, it is possible to work other certain contents given in the study plan, such as the measurement of angles, as, for example, in the following situation: first, put the buttress in the center of the coop. The other poles should be placed to build the chicken coop fence. Assuming that there are 9 poles to construct the fence, their disposition can be used to discuss angle with vertex in the center (central buttress). With 9 equally spaced struts, discuss the possibility of forming the angle (with vertex in the center) of 90°, explore the notions of right, acute and obtuse angle, as well as operations with angle measurements. An analysis can also be made of the type of angle (classification in relation to the internal angles) to be determined between the central buttress and the others that surround the chicken coop, in order to determine which one offers a greater support for the structure.

As expected result, the study plan suggests "bringing students and educators to be subjects articulated with the family and community to improve production conditions by measuring data and producing in a planned way using scales, measures of angles and percentage" (Movimento dos Trabalhadores Rurais Sem Terra, 2013, p. 157).

The proposal to work with the mandala vegetable garden is recommended for family agriculture, since it does not require a large area for planting and because they are simple and sustainable management techniques. As in each bed there is a type of vegetable (short cycle vegetables), the mandala garden maximizes the production in a small area and with few expenses. In this sense, it is possible to promote a discussion with students about the possibilities and the advantages or disadvantages of this strategy of planting in their communities. For example, discuss the relationship between the area that is available for the construction of a mandala garden and the area that the garden will effectively occupy. Being a rectangular area, how to deploy the mandala system in order to explore a larger area of available space? What is the ratio between the area

actually used for the garden and the area available for planting? Considering the available area, what percentage of the area is actually used by the mandala vegetable garden?

Mathematics concepts related to ratio and proportion can be approached in the study of the garden plant and its execution, converting the measures and orientations present in the project and the decision making when constructing the vegetable garden. One can also problematize unforeseen events, such as the reduction or increase in the radius of the concentric circles, that is, of the beds, aiming at a better adaptation of the project to reality. In this way, how could the modifications to be performed in the construction process of the mandala vegetable garden in relation to the original project be interpreted? How to maintain proportionality in the project, in the garden effectively implemented, after the modifications were made?

Another issue that is pertinent to the approach in this portion of reality, including ratio and proportion occurs in the manufacture of biofertilizers. According to Souza (2014), one type of fertilizer used in the settlement that was investigated was composed of fresh cattle manure, sugar cane molasses (which can be substituted by *rapadura* sauce - hardened sugar cane molasses - or sugar cane juice) and ash. To make a biofertilizer recipe, 7 liters of molasses were used for 15 kg of cattle manure and 5 kg of ash. Therefore, it is possible to deduce the quantity to be used there is intention to produce a greater or lesser amount of the biofertilizer. To do this, the proportionality of the initial quantities must be respected. It is noteworthy that the amount of manure is three times the amount of ash and that the ratio of liters of molasses and kilograms of manure is $\frac{7}{15}$. In conclusion, it can be observed that, when you know the ratios between the ingredients that involve the production of the fertilizer, you can produce values bigger or smaller than the original recipe, guaranteeing the proportionality.

Thus, when working the content numbers and algebra - ratio and proportion foreseen in the study plan, you have as expected success:

> To use rule of three for several operations: compare prices, assemble prescriptions [...]. Use algebraic calculations to abstract data in property, community, and production planning. Use percentage calculations to understand the situational advances of agrarian reform and agribusiness in Brazil (Movimento dos Trabalhadores Rurais Sem Terra, 2013, page 157).

5. Some considerations

This text aimed to present two pedagogical proposals, through the complex method, from the portions of the reality "struggle for agrarian reform" and "food production", suggested by the study plan (Movimento dos Trabalhadores Rurais Sem Terra, 2013). Besides mathematics, other subjects were contemplated, as the complexes suggest, in those cases, Portuguese language, geography and sciences.

Those proposals sought to exemplify guidelines to the curricular project of the itinerant schools of Paraná and address the issue of social justice. The discussion approaches both the inequality in access to land (complex 1 proposal) and possibilities of expanding food production in a sustainable way (complex 2 proposal), providing, in this way, reflections on the consequences of those debates and actions of struggle and resistance.

We believe that a deeper discussion of those proposals requires that they are developed in the context of an itinerant school - both to discuss them with teachers and to involve students in this process. However, in other research we have been conducting, we realized how difficult it is to put into practice the complex method. Several factors contribute to it, but we should mention one of them, especially: teacher turnover. Most teachers who work in itinerant schools are hired as PSS[11], which feeds the following cyclical situation: teacher contracts are temporary, causing teacher turnover in these schools. The new teacher takes time to understand the curriculum proposal of the study plan and, when this happens (if it happens), his/her contract is about to be finalized, and another teacher is hired. Furthermore, it is important to point out that many PSS teachers need to take classes in more than one school, due to the precarious remuneration - which hinders any kind of interaction between teachers to draw up proposals based on the complex method. In this way, we put ourselves in the position of a teacher of the itinerant school and, with time, studies and research, we elaborated pedagogical proposals that constitute a first movement in the direction of effectiveness of the curricular project. We intend, in a future moment, that these (or other) proposals be mobilized in the school environment with the participation of teachers and students.

We end by sharing a question that has worried us throughout the writing of this text. As presented, the complex method was brought to the context of the itinerant schools of the MST after several experiences with Paulo Freire's generative themes. Their limitation, according to Sapelli (2013), would be the uncertainty on whether all the contents of the several subjects would be approached; the complexes, in turn, would be constructed from lists of predetermined contents, avoiding that the same problem happened.

What troubled us, especially with regard to mathematics, was the apparent non-questioning of the importance of those contents in school education. With the linkage of content to the portions of reality, there seems to be an understanding that they are useful or even necessary to approach those themes. However, in many cases, we understand that either the proposals can become too artificial, or the portions of reality, which should bring together the discussions of the complexes, may be so far removed from the content, that they are no longer central.

Thus, we consider it important that research be carried out in the scope of mathematics education, to elucidate historical, political and pedagogical aspects of the curricular construction of the complex method, making possible to question the mathematics training of those itinerant schools.

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[11] PSS stands for *"processo seletivo simplificado"* (simplified selective process). The reference is made to teachers who have not passed public service exams, but are hired through that process. The distribution of classes of the state education network occurs primarily among the teachers who passed public service exams and, if there are any remaining classes, they are assigned to the teachers qualified and classified by the PSS.

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