Kyriakopoulos, G.(2022). Ethnomathematics and post-qualitative inquiry: reconceptualization of a mathematics curriculum with Roma student. *Revista Latinoamericana de Etnomatemática.* 15(Especial),59-77.DOI: https://doi.org/10.22267/relatem.2215E.95

Artículo recibido el 15 de Septiembre 2021; Aceptado el 22 de Noviembre 2022.

Ethnomathematics and post-qualitative inquiry: reconceptualization of a mathematics curriculum with Roma student

Etnomatemáticas e investigación poscualitativa: reconceptualización de un currículo de matemáticas con estudiantes gitanos

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Abstract

Reconceptualization of the mathematics curriculum with Roma students adapts a methodologically alternative research model where the researcher explores the common areas of mathematical knowledge. This exploration reveals a rhizome which portrays the possibilities offered to the educational process when mathematics curriculum is oriented towards the culture and the historical present of the students. On the occasion of the birth of a child, a series of mathematical activities which are adapted to their historical present and acquire meaning and substance through everyday life is developed. The developed rhizome gives the opportunity to understand the essence of their daily life and to examine power relations and way of action of this specific cultural group through mathematics.

Keywords: *mathematics currere, rhizome, Roma students*

Resumen

La reconceptualización del currículo de matemáticas con estudiantes gitanos adapta un modelo de investigación metodológicamente alternativo donde el investigador explora las áreas comunes del conocimiento matemático. Esta exploración revela un rizoma que retrata las posibilidades que se ofrecen al proceso educativo cuando el currículo de matemáticas se orienta hacia la cultura y el presente histórico de los estudiantes. Con motivo del nacimiento de un niño se desarrollan una serie de actividades matemáticas que se adaptan a su presente histórico y adquieren significado y sustancia a través de la vida cotidiana. El rizoma desarrollado brinda la oportunidad de comprender la esencia de su vida diaria y examinar las relaciones de poder y la forma de acción de este grupo cultural específico a través de las matemáticas.

Palabras claves: *curso de matemáticas, rizoma, estudiantes gitanos.*

1. INTRODUCTION

In contrast to the humanitarian tree and its influence in the field of education, a rhizome is a non-linear, non-hierarchical network that grows and changes.. According to Deleuze & Guattari (1987) the rhizomatic thought promotes creation of a rhizocurrere able to drive the study of social interaction in educational contexts to the deconstruction of arborescent models deterritorializing, thus, common misconceptions that have an impact on education. Rhizomatic thought does not seek to replace standard humanistic research models with a superior one. Instead it proposes multiple entry points (Colebrook, 2021) and multitude of

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pathways, resulting in a commitment to knowledge forms that are not linear, reconceptualizing the way an ethnomathematics curriculum (Naresh, 2015) may be developed.

While researching rhizomatically, educational process and becoming at the level of individuals and situations involved, both interact as elements of a labyrinthine and incalculable (Lather, 2016) rhizome which consists of discontinuity, rupture and constantly emerging multiplicities. Rhizomatic thinking moves from a unified, conscious and rational epistemology of human consciousness to a relational ontology (Walsh et al., 2020). Such a standpoint requires a radical review of the methodological approach to the reconceptualization of the ethnomathematics curriculum as conventional research efforts end up imposing codifications similar to those of linear models in research environments such as education and curricula that develop independently of hierarchies and predetermined desired outcomes as a rhizome assemblage.

This paper is part of a wide doctoral research focusing on the reconceptualization of the mathematics curriculum with Roma students presenting a nomadic exploration of the teaching of mathematics. An alternative methodologically privileged model is proposed which identifies the particular from within rather than from a distance (St. Pierre, 2018). According to Deleuze & Guattari (1987, p. 387) the researcher may act as a nomad who has no history, no territory, no goal or aims as he travels between points without ever stopping. The main aim is to indicate how researching for an ethnomathematically oriented curriculum reconceptualization might be enlightened by rhizomatic research where common spaces of in-between are constructed by a confabulative conversation (Johansson et al., 2021) between Roma students and the researcher who takes up a nomadic position.

Research aims to contribute to new ways of thinking and further innovation in a mathematical way or seeing the reality of Roma students through mathematics. It focuses on specific ‘actualities’ which shape the sociocultural reality of the Roma community and drawing on them emerges as a response to the neoliberalization of mathematics education (Heimans & Singh, 2016). Research seeks to provide means to produce ideas and make conclusions that run counter to hasty and easy conclusions aimed at categorizing schools, students and teachers.

2. QUESTIONING METHODOLOGY

Based on the work of Deleuze and Guattari (1987) as described in Taylor and Harris-Evans (2016) everything on a research process exists on a plane of immanence without hierarchies

or predetermined orders. Ulmer (2017) mentions that "thinking differently about methodology is an ethical, political, and intellectual imperative (p.12)" so the education of mathematics is seen as a political action which may be able to transform the lives of the persons involved. Postqualitative inquiry is not a qualitative methodology with a twist (St. Pierre, 2021) but it expects the researcher to step outside of the safe methodological steps into the exploration of the post-human societal condition focusing on matter and its contributing role in the production of our worlds (Spyrou, 2019; p.316). In a rhizomatic direction this paper proposes new possibilities for educational growth and inspiration—new teaching actualities for knowing and being both as a learner and a teacher (Le Grange, 2018).

Educational reality suggests mathematics teachers record the learning objectives in advance and the teaching strategy they will adapt to achieve it. Moreover teachers will be in a process of evaluation of this teaching process in terms of whether they have achieved the goals and objectives or not. Mathematics curriculum tends to degenerate into a failed representation of the desperate efforts of educational stakeholders to capture topics and turn them into useful and validated knowledge. The researcher, in this perspective, has dominant knowledge of the student's world acting thus as a colonialist and the research itself seeks to impose a change on that world.

Post-qualitative inquiry and rhizomatic thought suggests such a mathematics curriculum to be deconstructed. This procedure can achieved when the curriculum is treated as a temporary possible proposal, a reality that emerges in a way beyond our control without frames, but in the dynamin interaction of specific alternatives on a map of possibilities (Deleuze & Guattari, 1987). The mathematics curriculum that will be reconsidered should not be written on a "butchers' paper that reminds us of the pedagogies of the slaughterhouse (Pedersen, 2013), nor on an immigrant paper that has come on a ship from London as packing material, yellowed by window sun" (McKnight, 2017, p. 11).

The process of curriculum deconstruction does not reject what it deconstructs but rather it proposes a lived curriculum experience, often referred to as currere, to create space for something different. Deconstruction rises when "something in the world forces us to think" (Deleuze, 1994, p. 139); when the given and the dogmatic image of thought, no longer suffices (St. Pierre, 2017). Deconstruction as an approach seeks to bring to light important deconstructive curriculum aspects through focus on sources of tension and disruption (Derrida, 2007).

The present research is carried out in an area located on the outskirts of Athens a short distance from the city center where Roma communities live. Conducting the research involves seven different Roma students of 3rd grade as well as important family and community members. Participants agree to participate in this research; they know the subject and the substance as well as the collection of relevant material by the researcher. This consent takes place both formally through a relevant consent form and substantially as community members allow the researcher and students to access their space and action at the same time as their daily activities. Students and community members are on track to acquire a culture of locating mathematics into everyday life activities and cultivate thinking in a mathematical way.

This paper's post-qualitative turn in mathematics education instead of looking for the students' truth, focuses on the differences, the contradictions and the setting in which their funds of knowledge are explored. Roma students have unstable and dynamically changing life experiences that cannot be studied in advance and approached with predetermined steps. Mathematics learning situations and educational opportunities arise in response to the students' living experience and their funds of knowledge. Deconstruction identifies and highlights (non)data which may lead to the reconceptualization of the mathematics curriculum, incorporating, with critical stance, political, cultural and historical elements that will reveal how Roma students interact with mathematics concepts through their lived experience. Mathematics curriculum develops an impressive rhizome where any node can be connected to any other which gives meaning to the learning process enriching student's mathematical experiences.

3. RESEARCH (NON) DATA

The research field is the region of Avliza which is located in a suburb of Athens where Roma welcome a new member into a family. This occasion acts as an actant which becomes a source of action: "something that acts or to which activity is granted by others. This family has a prominent social and economic position in Roma society, thus, the birth of their child is accompanied by a series of real life events, which acquire special meaning for the participants and have the potential to be transformed into mathematics learning situations. Thus, some specific constructions are created in the area next to the family's house in order to protect the baby from possible danger that may enface. This series of events, unfolds a mathematic rhizome of activities and mathematical notions which are important for the students and becomes the focus of the research. The research focuses on activities where

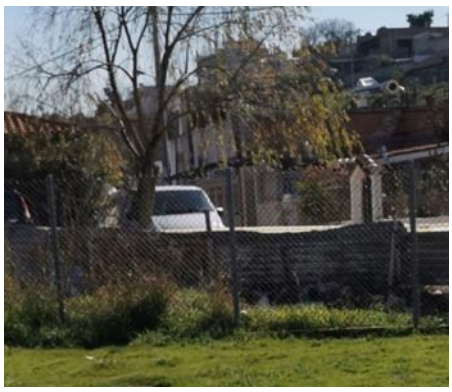
students are involved in order to deal with mathematical situations in a dynamic sense of viewing mathematics curriculum.

3.1 Episode 1

According to Kyriakopoulos (2022; pg. 250) "The first activity concerns the construction of an improvised fence in the neighboring stream (figure 1) in order to prevent a baby from falling into the water while preventing the various rodents that live in this polluted environment from circulating in the neighboring road and inside the houses. On this occasion, there is a

Figure 1

Fence in the stream



Fuente: Kyriakopoulos, 2022

discussion with the students. We discuss about the way their parents (as well as the students themselves who always help their parents in construction activities) count in order to understand how much length they need to block as well as how to determine the amount of material they need to gather to complete the project".

In the photos, we notice the improvised fence that the Roma have built on a torrent's bank, which consists of rectangular pieces of plastic and tin. The students report that the measurement is conducted with brooms. "The broom's pole length, you count how many poles and calculate the distance" Gregory states. This means they do not use the meter tape at all. Then the researcher asks them what happens if they need to measure something high that they do not reach, such as a tree and Gregory typically states, "Since I do not reach the tree, I see the tree that has a sign from the sun in the yard (meaning the shade of the tree). So, I count the sign with my feet, one, two, three feet, three meters and then I put (meaning I add) the part that is behind the wall, that the sun does not catch, let's say one point eighty, and three, four point eighty and a little more because the sun loses, let's say five, five and a half." In this excerpt from the verbal description of how the student calculates, we understand that students use an approximate method based on certain assumptions.

First, they use the shadow of a tree to measure its height in steps. They know that a large human step corresponds to about one meter, so they calculate its length by adding any parts that are not reflected in the shadow of the tree – such as the one behind the wall in this case. Since the wall prevents the depiction of the trees' whole trunk in its shadow, the tree's trunk appears from one point and above.

It is also interesting how they calculate "one point eighty" since Moglis typically states "I conclude it is one point eighty – 1.80 – because you are about the same, you are one point eighty, one point ninety" meaning the height of the researcher. At this point, we find that Roma students are absolutely familiar with the concept of human height as they can calculate human height with almost absolute accuracy. They also compare the height of a person with the height of objects.

According to Kyriakopoulos (2022), in this case, it is not easy for them to calculate the height of the concrete stand behind which the tree is located, (this stand prevents the shadow of the tree from one point and below and for this reason is involved in the measurement process). However, they realize that the stand is the same height as the researcher. They accurately calculate the height of the researcher since they are familiar with people's heights and then use this ability to measure different objects by making the necessary comparisons. Finally, we observe that the student has a feeling that the sun "loses". This practically means that his approach is not accurate, so he adjusts his final answer by correcting the length and even increasing his estimate by a few centimeters.

The researcher then urges the students to calculate exactly the height of the tree as well as the length from the makeshift wall they are making. This confuses the students and one of them, Dimitris, obviously irritated answers: "Dude, what do you want exactly? What will you do with the tree? You only care it does not fall and brings the cables down. Five meters from there (meaning the side where the power cables pass) if you drop it, I tell you there is no problem. The same happens with the fence, we measure with broomsticks, I take the broomstick with me to the place I go to collect the tin and the plastics and I count up to how many I want. And if there is any dog I send it away"

At the same time, another student, in order to relieve the intense irritation in the atmosphere, explains "Teacher he means that you don't always have a tool in the laboratory – where the wooden tables are made. You measure comparing one object to the other. Here in the classroom, if you want to measure the closet, you measure using the desks or chairs (meaning how many desks the length of a chair corresponds to), you then take the chair and go

wherever you have to work. We had once brought a "Balamo" to close my grandmother's yard to construct one more room for my aunt. He measured everything using paper and a calculator. Do you know how many left overs we had, teacher? Bits of all the materials found all around. Waste of money. Teacher, the way we measure materials nothing is left over, everything comes out accurately".

According to Kyriakopoulos (2022), "through this incident, we observe that Roma students are purposefully using their way of measuring distances. They use their experience and the practical significance of each measurement to calculate what they need. In our case, they are not interested in accurately measuring the height of the tree since this activity is automatically adjusted in relation to their daily life that is whether the tree can fall on the power cables. Whether there is a potential risk of a possible tree fall.

After all, the calculation of the length of the tree's shadow on the ground is clearly related to how far the tree will reach after a possible fall. In other words, they directly connect a mathematical issue, such as measuring the height of a tree according to its shadow, with its practicality as well as with the extensions of this practicality into matters of security. They consider whether there is a risk of injury or electric shock in the case of a tree falling and are content with this calculation that will ensure a correct answer to the practical problem they have. Outside this living experience, students do not find it meaningful to measure the exact height of the tree because they certainly do not need it".

Accordingly, Roma students associate the importance of a measurement with its results and the practical implications it may receive. A "Balamo" follows an accurate measurement that may be made by a specialized engineer, they obviously mean an engineer whom they consulted for building the extra room or a building material clerk who measured and calculated the amount of materials needed. This measurement will provide some data, which form the basis for purchasing appropriate quantities of materials. This data will be rounded to buy the required materials depending on the packaging sold by the building materials' stores.

In our case, the Roma go into the process of buying extra materials, which were finally left over resulting in a waste of money and unnecessary garbage. On the contrary, using their own strategy, they do not have surplus materials because they measure exactly how much they need and then buy or collect the required quantities. In fact, the instrument they use can also be used for their safety by removing the aggressive dogs during the process of collecting or purchasing the materials.

Kyriakopoulos (2022) states that “this contradiction creates controversy in the Roma society because community members find it difficult to understand why they have an excess of building materials, accusing the “Balamo” engineer for insolvency. At the same time, they devalue the essence of the measuring process as it gives incorrect results that causes financial loss, which could have been avoided if the calculation had been made in their own alternative way. As a result, students are not happy to participate in accurate measurement processes even if they are related to their daily lives because there are negative experiences that deprive this process of its meaning and usefulness”.

3.2 Episode 2

Here will be presented an activity which has as its starting point the birth of the baby is related to the construction of a new, additional room to accommodate this new member. Indeed, as shown in the pictures below, the Roma are buildinga makeshift room (figure 2). Unfortunately, its construction took place at a non-conventional time, during the night, to bypass the legislation on illegal construction. Thus, it was not possible to participate in the process from the first stages of

building the new room. However, the researcher and the students were on site on the installation of the electrical network. At this point, teacher-researcher and students interacted with three separate arisingmathematical situations.

Figure 2.

A makeshift room

Fuente: Kyriakopoulos, 2022

During the electrical installation process, the measurement techniques are distinguished in two basic cases. The first circumstance is to measure the necessary length of the cable needed

in order to lead the cable through the electrical channel to the house's electrical panel. We notice that Roma students. help their parents as they are asked to measure the length of the plastic channel which the power cable will go through.

Figure 3.

Measuring with finger

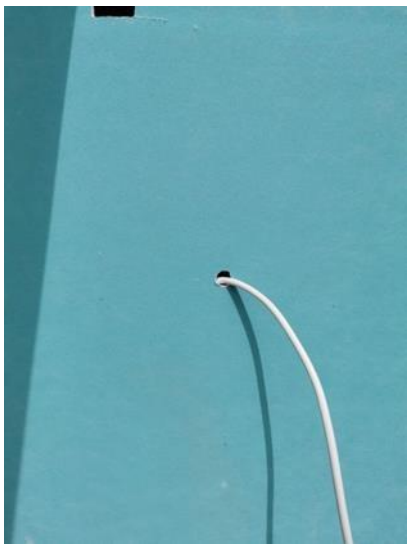
Fuente: Kyriakopoulos, 2022

Instead of measuring with the measuring tape -which is also available at the construction site- all those involved improvise measuring with their hands and showing the plastic pipe's length with their finger (figure 3). Then they cut the plastic pipe

exactly to the length needed to match the wall. Ephraim typically states, "Teacher, with the measuring tape you can only measure what is exact. If there are halves, it makes things difficult and then you have to rub to match it exactly. With your finger, you cannot go wrong. The thing is not to make a mistake because you will have to do everything again, you will lose time and you will be caught, teacher. Speed counts". Moreover, a father says "Here we talk, laugh, drink. If you use the measuring tape, you forget what you have measured. Using your hand, you do not have to use your brain. The more you catch, the more you cut". Through this incident, it is obvious that each of the measuring techniques they use is not accidental but acquires specific meaning within the context of their funds of knowledge. Students face a cognitive difficulty as they find it difficult to calculate the millimeters as shown on the measuring tape. However, at the same time they prefer to use their hands in order to be less focused on their work. Thus, students can communicate, converse and have fun while working. In fact, this process becomes a part of a wider Roma community celebration.

Figure 4.

Parallel and vertical signs of



Fuente: Kyriakopoulos, 2022

At the same time, the electrical cables that form a circular shape are observed and the researcher asks the students how they decide how much cable they will buy (since in the shops you find them in circular coils) in order to have no excess as it is required for not spending additional money. Vasilis typically explains, “I take a round one from the cable (meaning a circle of cable), pull it out of the coil and straighten it to see how much it is. This is about as long as the length between the palm and the elbow. I count how many hands the wall is and in the shop where I go I count the rounds on the cable. The more hands there are, the more rounds you need. I buy as much as it comes out”. At the same time, his father adds, “the cablehas a loss – he means that pieces are left over while some others are cut – so you take a dozen more rounds to last out. The little that is left over you put it in the lamps afterwards, it is not wasted”. In other words, because it is not ease to cut a specific piece of cable to measure the required length, they have matched the length of the circle to the length of the arm (figure 4). Using this approach, they can easily calculate the length of the cable that Roma students need to buy in the shop by measuring exactly how many circular cable sections they need.

However, the researcher notices there is a measuring tape in the improvised construction they are preparing. Asking the children why there is one at the construction site while they do not use it at all, the students characteristically answer, “This has been forgotten by the Pakistani who will come to put the aluminium windows. Teacher, aluminium does not allow for repairs and mistakes. If something goes wrong with the aluminium, then you are left with a hole that allows air and water to come in. He knows and counts them properly because he knows we will beat him to death if he makes a mistake”.

It is therefore understood that students have a relative familiarity with the accuracy provided by the standard measuring tape even though for their own reasons, as mentioned in the individual examples, they do not prefer it. However, when the works require detail such as the installation of an aluminum window then they highlight and accept the usefulness of the standard measuring tape and the corresponding measuring tool. At the same time, we observe that they apply an improvised technique for measuring the circle's length. They measure the length of the circle; they convert it to a length corresponding to a straight line and then adjust to fit the actual meters needed.

Consequently, some special social issues arise. Although Roma students and their families experience intense violence and prejudice, Roma students come to reproduce violence in social groups that they consider inferior to them. Many Roma host immigrants of Pakistani origin who live illegally in Greece and treat them in the same way Roma themselves experience racist behavior by people from the dominant culture. Violence breeds violence and stopping its reproduction is a matter of education. The Pakistani craftsman who is an aluminium technician becomes valuable to the local Roma community and, in this context; discrimination and violence against him are reduced because of his mathematical knowledge that allows him to use the measuring tape with millimeter accuracy.

Then, it is observed that we need to accurately measure a point which the cable will go through. In order to do this, they measure the distance from the hole at the top of the plasterboard to the point they want with their palms, on the vertical axis. Then, they measure again with their palms a distance on the horizontal axis. We observe that during the measurement they note a soft dot that shows the exact distance on the vertical axis.

Through this process, students realize that there are two conceivable parallel lines at a set distance from each other. Such measurement and design practices find direct application in Euclidean geometry and, in our case, the set distance between two parallel lines is one of the fundamental theorems of Euclidean geometry. The Roma use the application of parallelism's theorem without knowing that there is a fact that confirms that mathematics is based on everyday life's real situations and cannot be considered on its own and independently of its practical applications.

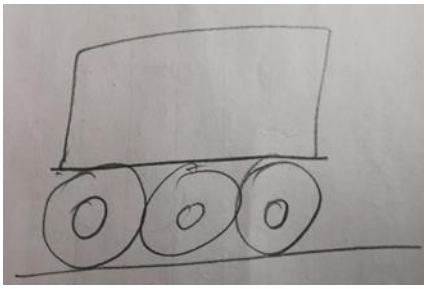
3.3 Episode 3

Motivated by the image of the cable, which has a circular formation, we discuss with the students about the concept of the circle's perimeter. Therefore, we may need to calculate the

circle's perimeter in an alternative way. That is why they usually point, "He is right. You cannot measure the car's wheel. It is not possible to cut it and make it straight. Not even the iron wheel of the train"

Figure 5.

Representation of a train's wheels



Fuente: Kyriakopoulos, 2022

The moment we deal with the representation of the train's (figure 5) wheel, Irene, who is a talented student in designing, seeks to develop specific measuring connections between the circle and the straight line through painting and suggests that "Teacher, let's accept that there are some wheels on a train. If you calculate how many wheels fit one another (she means in a straightline) equals the train's length". We asked Irene to represent her thinking in a sketch and design us the figure in picture 9, which finally presents that the length of a circle's diameter equals the length of the corresponding straight line.

This is to understand that the student confuses the length of the circle's perimeter with the length of its diameter. Students are young enough to present them the concept of mathematical process involved in the algorithm that measures the cycle's perimeter, we take advantage of Irene's talent in designing and offer the opportunity to a group of students to create a train using real paints on the school's wall. The aim is to focus on the required emphasis on the train's wheels so that the students will overcome their cognitive obstacles in an experiential way(figure 6). Irene states with enthusiasm "Teacher, I know how to draw trains very well. Since I was a small child, we lived above the trains. I saw them every day. Theywere next to our house".

Figure 6.

Understanding that the wheels of the train needspace

Fuente: Kyriakopoulos, 2022

During this activity, with the help of the Art teacher, the train carriages were initially designed in pencil. The train's wheels were not designed in advance to offer the students the opportunity to act on their own and expand their reflective thinking and reasoning using their funds of knowledge.

When Irene got to the point of drawing the train's wheels, the researcher asked her why she did not follow the previous drawing she has made on the paper where there was no space left between the wheels, since this is how their length can be estimated in a proper way. The student answered that "There is no real train that has wheels one next to the other. If the wheels come one next to the other the train will not be able to slide. They want apla (it means space) to turn. The other was a painting. You asked us to make a real one here, didn't you, teacher?"

In other words, we understand that the student realizes through her funds of knowledge and specific observation she has made in her real life that the length of the trains' wheel is greater than its diameter but she lacks the mathematical capacity to express it in an appropriate way. This emerges from the fact that while she discusses with the researcher she mentions that "the middle circle, let's say if we spread it (shows the two concentric circles formed with different colors on the train's wheel) does not match, will go out of plan. They have also said it yesterday when talking about Cuckoo's cable (she refers to the previous incident described and concerning the measurement of the electrical cable). That is why they said that the cable has a loss. You cannot find exactly how much it is. You overanalyze it. Is the outside circle the same as the inside?"

Analyzing this specific incident, when the student draws without specific purpose she is not interested in depicting the real details of the train wheels accurately. On the contrary, when she is called to draw something that is more significant, such as a whole painting on the

school wall, she uses her experience to depict the train's wheels as in reality. Her funds of knowledge relating with trains makes it clear that the wheels must abstain from each other to permin the train move. The student even can justify through this experience the circular arrangements. As she claims not all the wheel circles have the same length (as compared with the identical train wheels) and this is the reason why they adjust the final result by "overanalyzing it" (she means by taking the appropriate corrective actions).

4. CONCLUSION

When I started researching for the reconceptualization of mathematics curriculum with Roma students I decided to follow a familiar and accessible path which would lead the research to safe results. While exploring the relevant literature I realised that the majority of research had something in common with the field of researching mathematics education with Roma students but none of them was able to portray reality accurately. Discourses were connected with each other through a rhizome of the text connecting through line of flights several discourses.

These discursive plateaus although they were weak to provide a strong theoretical background for my research because they could not give sense standing alone, they acquired meaning when they were formed as a rhizome able to demythologize official curriculum texts and encouraging students and teachers to enter into dialogue with their epistemological assumptions, rather than accept them as given (Murris, 2017; Kennedy, 2012).

The issue of Roma education has been widely discussed both scientifically and on a daily basis, with the result that this vast array of individual experiences on the subject of Roma education acts as a hurdle to the application of traditional research approaches for mathematics curriculum reconceptualization as a lived experience. This practically means that both qualitative and quantitative research methods conclude in highlighting common sense issues. Even if a traditional research approach was based on the principles of intercultural education, again the researcher would give a colonialist style to the subject under study.

Intercultural orientation should stand as an element of the quality of pedagogical practices (Abacioglu et al., 2020; Appelbaum & Stathopoulou, 2015). Relevant literature presents each assumption as final and authoritative guidelines for learning while this research endeavours to introduce a style of deconstruction and reconstruction into the learning process for the valorization of actual, immediate instances which are organized as a learning rhizome and result in real democratic action.

This paper's (non)data could be interpreted as an illustration of Ruitenberg's (2010) point about the importance of engaging in discussions specific, concrete examples of political injustices within an agonistic approach to democratic education. Ruitenberg writes, "an inductive political education, then, would begin not with political theories or the abstract request to, 'imagine a desirable society' but with discussions of concrete perceptions of injustice" (Ruitenberg, 2010; p.53) and goes on to argue that, "in a political education worthy of the name, we have to engage students in these difficult discussions".

Patti Lather (2016) observed that "the method is political and that is a good thing to think with as we explore how much the development of a counter science "on our own terms" can be community based, community sustaining, and community serving in ways that might help alter the structures of institutions in more expansive democratizing ways". The activities presented in this paper have developed a mathematics rhizome. The rhizome is structured by a series of activities that touch students' funds of knowledge, explore issues of social inequality and are transformed into mathematical activities through everyday life. It is a fact that these activities could not have been structured and organized in advance as they arise unexpectedly and spontaneously during the research process.

However, they are organized in the rhizome as shown below and acquire a meaning and substance for the life of the students as well as for the cultivation of mathematical knowledge and mathematical skills. Deleuze's philosophy through transcendental empiricism is able to describe the ways in which experience and reality as perceived by Roma students, connect events and create their experiences and identity. The researcher in this case cannot have pre-formed perceptions and research approaches as research field unfolds in front of him while experimenting, creating, becoming and re-orienting thought. Researcher's identity is shaped together with the currere that is shaped during the research process which portrays a lived experience of the curriculum (Pinar, 2013).

This paper approaches the subject through real field experimentation and validation of the lived experience, allowing for space for new entry points that may arise in the process of curriculum development. The discursive implications that are derived from Roma students lived experiences and facts of knowledge are treated with transcendental empiricism but are not intended to claim for an undisputable universal truth about the curriculum development. The students' life change takes place simultaneously with the research and the validity is developed through the eyes of the Roma students who experience the change in their daily practice connecting mathematics and life and responding thus in some critical points they

face. New ways of thinking and dealing with the reality emerge through engagement with mathematical concepts and funds of knowledge, bringing about long-term and short-term dimensions in the daily lives of Roma students.

Gerrard et al. (2017) mentioned that "post-qualitative inquiry challenges the authority of research that searches for 'truth' in the experience of others" (p. 390). This theoretical and philosophical (non) methodological approach combines philosophy with research methods that allows the researcher to access data and resources that have been collected throughout the life of Roma students, through emotions, memories and perhaps art forms.

Postqualitative inquiry is mainly characterized by its immanence (St. Pierre, 2019) makes the research not to repeat systematically preexisting research, reprocess to produce a recognizable result, but to experiment and offer something new and different that "might not be recognizable in existing structures of intelligibility" (St. Pierre, 2018). This thesis is not to instruct the research community towards "what is to be done" but it aims to bring interested parties to a point where "they no longer know what to do". Deleuze (1994 p.136) explains that when specific thoughts and practices are considered as authority of knowledge, they should be treated "every time as something which has not always existed, but begins, forces and is under constraint".

Summarizing the above, in case of a teacher being interested to try ti make such a rhizome happen in their own classroom/environment, here are some guidelines and principles in order to get started. Initially, substantial and in-depth knowledge of the social and cultural background of their students is needed. Cultivating relationships of trust with students and important others indirectly involved in the learning process is also necessary. Empathy for the issues that concern students is of great importance. A thorough study of the philosophical theory of the rhizomatic thinking and an awareness of the potential it can offer to the learning process should also be a topic of focus. Vigilance during the educational process in order to take advantage of the opportunities for co-shaping a mathematical rhizome with students should always be in a teacher's mind. The teacher should develop the ability to turn students' historical present situations into mathematical problems even if they initially seem unrelated. Teachers should develop persistence and faith in the effectiveness of such a rhizocurrere and not be intimidated if the result is incompletely unrelated and produces confusing information.

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