Method as a Creative Instrument for Researching on the Formation of the Teacher Trainer of Teachers (Mathematics)

Deise Leandra Fontana

PhD student at the Graduate Program in Education at Federal University of Paraná (UFPR). Professor at Federal Institute of Paraná (IFPR). E-mail: deise.fontana@ifpr.edu.br. +55 41 3535-1647

Ettiène Cordeiro Guérios

PhD in Education at Campinas State University (Unicamp). Professor at the Postgraduate Academic Programme and at the Postgraduate Educational Practice Programme at Federal University of Paraná (UFPR).   E-mail: ettiene@ufpr.br. +55 41 99972-2140

Abstract

This text derives from a doctoral research that investigates the aspects of education of the teacher trainer who instructs mathematics teachers. It has as main theoretical reference Gaston Pineau and Edgar Morin. The general goal of this work is to present moments of an investigative process that has as its area of study the formation of the teacher trainer who instructs mathematics teachers. The methodological assumptions include building blocks of eco-systemic and complex thoughts. The method adopted is relational between Oral History and Grounded Theory. The method unveils possible dimensions in the formation of the teacher trainer in a qualitative research. The results of this study can help to understand the nature of dimensions of the teacher trainers´ formation, which are based on their experiences with themselves, with others and with the environment.   Thus, it includes a new approach to temporalities in the formation of the teacher trainer, from the insertion of the principles of complex thoughts.

Keywords: teacher trainer; method; creative insubordination; grounded theory; oral history;

1. Introduction

This text presents extracts from a doctoral thesis that investigates the possible formative temporal movements in the formation of the teacher-trainer of teachers who teach Mathematics, thereby constituting the dimensions of teacher training. Some of the theoretical-interpretative moments of the investigative process was shared here. Firstly, it was addressed some of Pineau´s contributions to the study of the bios-logos dialectics, which is fundamental for understanding the movement of origin of life histories that are in formation.

Secondly, this paper highlights the polysemy of the oral history concept, through the knowledge of the "oral history method". Sequentially, it is presented the Grounded Theory (GT) and a general construction of this theory, from the perspective of Charmaz (2009). Therefore, the writing is moving towards the

constitution of a methodological dimension of research in a complex and creative insubordination perspective. Some gaps from previous developed studies are presented, evoking the initial theoretical assumptions. It is emphasized some central ideas of the theoretical relations constituted, and of the expectations for the continuity of this study, as a provisional conclusion.

2. Theoretical Basis

Pineau (2006) is a genealogical reference for thinking about life stories as arts that shape existence, from a synthesis of the historical panorama of dialectics that exists between discourses (logos) and life journey (bios). For the author, "[...] the terminological fluctuation around stories and life reports, biographies and autobiographies it is the indicator of a fluctuation of meanings attributed to these attempts of expressing the one´s personal temporality experienced." (Pineau, 2006, p. 42, emphasis added). These attempts reveal scientific positions and evoke science with awareness of existence.

Pineau and Le Grand (2002) conceive life stories as an autopoietic practice of research and construction of meaning which is based on personal temporal facts, and involves a process of expression of experience. Morin (2011b) addresses the essence of meaning, based on two propositions: "1. meaning is an emergency that, coming out of the activities of language, not only has an uninterrupted feedback on these activities, but constitutes its global synthetic level. [...] 2. The meaning is hologrammatic." (Morin, 2011b, p. 207-209). According to Morin (2011a) life mobilizes "[...] formidable organizational complexity" and "[...] must adapt, that is, must be inserted and integrated into its means of existence, and this means of existence, that is, the ecosystem, imposes its determinisms and influences on all living creature. " (Morin, 2011a, p. 79). Thus, the ecosystem circumscribes the expressions of life experiences.

For revealing historical background of dialectics between discourse (logos) and life journey (bios) the author cited uses Dufour´s matrix (1990 cited by Pineau, 2006). The matrix represents three major historical periods - pre- modern, modern and postmodern - and the bio-logos dialectics. The model assigns different senses (affective, connotative and cognitive), however intertwined. It seems to oscillate between two poles: the existential, of personal life journey, and that of formal signs, of transpersonal discourses. In the pre-modern vestiges of philosophical dialogues, it is perceived the different attempts of writing the self. According to the author:

> Reserved for Lyceum and a political elite as a philosophical art of knowledge and self-care, the bios develop socially in Greece and in the Roman empire as a media art of social communication for the lives of notables or people deemed exemplary. Plutarch, in the first century of our era, was considered the father of biography with his Lives of illustrious men. From the beginning, they appear the two major functions of the construction of traces of union between logos and bios: forming unique lives and communicating them socially. (Pineau, 2006, p. 47, emphasis added).

Pineau (2006) also highlights the hybrid power of writing - the written word and the appropriation of

scientific discourse - and of its appropriation for science construction. From this perspective, he remarks that the postmodern and transdisciplinary periods use multimedia forms of expression and communication, changing the bio - logos dialectics. According to the author:

> This postmodern and transdisciplinary multimedia explosion develops the more the movement of life expression by the living creatures outside the professional, scientific and political-religious spheres, which were inherited, as life itself is problematized, in all its multiple ways of living synchronously (unifying psychic, social, organic biodiversity), and diachronicly (joining before and after, memories and futures, from pre-birth to post-death). (Pineau, 2006, p. 52).

The entry of life into history proposes reflections on the new conceptual spaces that are developed in order to questioning vital problems. There are rustles of a bio-question: what is life? Is a question to be discussed in biological modernity or an original epistemological bio-obstacle? This is the challenge the author presents. In the body of the thesis there is the study of the experiences of teacher trainers who teach mathematics as a conceptual space of knowledge and training.

The research participants are teacher trainers who work in Pedagogy and / or Mathematics degree courses at private and public higher education institutions. It was adopted the geographical proximity of higher education institutions (HEIs) as inclusion criteria. Moreover, it was adopted non-signature of Informed Consent (IC) as exclusion criteria, as well as, non-performance in undergraduate courses that educate teachers who teach mathematics.

Training, seen as a relational and interdependent system, includes self-training and eco-training as opposite and complementary poles. Such discussion will not be addressed here because the main goal is to approach complementary methods as a possibility for a theorizing practice in the field of education of teacher trainer who teaches mathematics.

The life that seeks to enter in history is also that who engage in the exercise of action-training research of vital problems, building meanings and introducing temporalities. Therefore, for representing some conditions for the bio-formative exercise of the arts of existence, Pineau (2006) remarks four of the items that structure the ethical charter of the Associação Internacional das Histórias de Vida em Formação (ASIHVIF) [International Association of Life Stories in Formation]. In summary, the conditions are: a) performing a personal experiential learning – someone life story; b) establishing means and procedures for learning from researching partners; c) producing shared material forms and, d) determining work meanings, its sensitization, its orientation and its significance.

This is the basis on which it was created an investigative process that addresses creativity in an educational research dynamic, rooted on ethical bases. The constitutions of creative insubordinations are constituted by different questions, among them, the methodological positions (D'Ambrosio & Lopes, 2015). The creative insubordination resulting from this perspective can bring a dialogue between the theories of education and mathematical education for the development of research. Based on D'Ambrosio and Lopes (2015), creating in a research practice it comes from the need of promoting learning from the training of researchers into mathematics education.

The interfaces of researching with the concept of creative insubordination are revealed by admitting the principles of complex thoughts, which help us to overcome the dichotomous way of thinking of Cartesian dualities: subject-object, reason-emotion, among others (Descartes, 1996). These dualities are manifested in the modes of perception of reality.

2.1 Oral History

Pineau presents, in historical-scientific terms, the polysemy of the term life stories. In view of the use of this method in the process of developing this research, it is opportune to address an introductory reflection on the addition of "oral" to life stories. Oral history, initially conservative, around 1948, emerges at Columbia University.

> Innovations in Oral History are based on its new approach, which is aimed at the provisional historical construction of versions and new ways of thinking, feeling and knowing. These forms are explained by interviews and produced jointly by interviewer and interviewee in the face of stimuli capable of allowing the reconstruction of subjective experiences and states. These elements reveal the representations of self and reality through narrative. (Ataide, 2006, p. 314).

The oral life story allows a more subjective view of the participants' experiences, based on the records of integral and singular reports. The documents are organized during a research process and developed based on a relationship of trust and interaction between interviewer and interviewee. Ataide (2006) exposes a theoretical discussion that consolidates the interdisciplinary character of oral history.

Authors such as Meihy and Holanda (2007) present some concepts of oral history, highlighting that this is a systemic process of acquiring interviews that is registered "in the present time". Oral history, as a method, centralizes interviews as a fundamental point of analysis. In addition, according to the authors: "for being assured as a method, the interviews need to be highlighted as the nerve of the research, and on them the results are implemented. Any complementary documentary dialogues should keep an eye on the themes arising from the interviews." (Meihy & Holanda, 2007, p. 72). It is possible to think about the time of interview perceiving the intensity of this process. Le Ven, Faria and Mota (1997) reflect on the process of remembering at the time of the interview in life history. According to these authors:

> Memory is neither chronological nor linear and we perceive it as a set of experiences that take place in space and time different from the current time - in the time of "remembering". And the moment to remember implies of remembering and imagining because only some of traits of the experiences can be evoked; they will never be represented - brought into the present again - as they happened in the past. Furthermore, although we can rescue the past, there are always gaps in memory: the memory of forgetfulness. (Le Ven, Faria & Mota, 1997, pp. 214-215).

Hence, the present moment that moves the memory is the intensive interview. Past emerges from lived moment and it is expressed through signs. Besides, there is the argument about "[...] the impossibility of revisiting the recorded experience, mainly in the face of all the distance from what had happened, and the countless experiences-memories accumulated in the present." (Montenegro, 1997, p. 200). Therefore, there would be a permanent movement to give new meaning to memory, which it is also supposed to be an experimentation movement.

From this perspective, "Life history, which is defined here as searching and construction of meaning which is based on personal temporal facts, involves a process of expression of experience." (Pineau & Le Grand, 2012, p. 15). This involves the individual's place of origin and his/her extension in biosphere. The experiences captured by interviews, as a mode of expression, through a project that integrates Charmaz's grounded theory (2009) and the oral history method (HO), explain one of the basic points that distingue oral history from conventional interviews.

2.2 Grounded theory

In the middle of the 1960s', sociologists Glaser and Strauss, by opposing the methodological assumptions of that period, proposed a systematic qualitative analysis, with its own logic, which was able to generate theory. Grounded theory in its origin starts from divergent disciplinary traditions: on one hand, the positivism of Columbia University; on the other, the pragmatism of the Chicago school. Therefore, the guidelines these authors wrote about the conduction of qualitative research modified the oral tradition and made the analytical guidelines accessible.

Charmaz (2009) clarifies that the grounded theory guidelines describe the stages of the research process and provide paths to this process:

> A process consists of revealed time sequences that can have identifiable boundaries with clear beginnings and endings, and reference marks between them. Time sequences are associated with a given process and lead to modification. Thus, individual events become associated as part of a broader totality. Even the most streamlined process may surprise, because the present results from the past, but it is never quite the same. The present raises with new characteristics (Mead, 1932). Consequently, however small, experience and the result of a specific process have some degree of indeterminacy (Charmaz, 2009, p. 24).

In further accordance with the author these guidelines are used with the 21st century's assumptions and approaches. It is highlighted an overview of the construction of grounded theory, from Charmaz´s perspective (2009). It is emphasized some research moments: a) collection of relevant data, with intensive interview and textual analysis; b) codification in practice of the grounded theory - initial coding and focused coding; c) writing memos - with extensive notes; d) theoretical sampling and saturation; e) reconstruction of theory in the studies of grounded theory - concepts of theorization; f) writing for elaboration of an analysis; g) reflection on the research process.

It is sought to reveal the movement of the grounded theory process. In this regard, It is emphasized some

of the stages of analytical understandings of actions and meanings apprehended. It happens in the ongoing research, from the sensitizing concepts to the writing of the first drafts.

3. Methodological Aspect

The methodological standpoint adopted in this text contemplates the constitutive assumptions of eco-systemic and complex thoughts (Morin, 2011a). In this perspective, "[...] reality is dynamic, changeable and multidimensional, at the same time continuous and discontinuous, stable and unstable. It is an uncertain reality and of a complex nature". (Moraes; Valente, 2008, p. 19). This reality is also constituted of non-linear and self-organizing processes. Moreover, according to the authors:

> [...] from complexity, subjectivity, intersubjectivity and the active, constructive, affective and historical learner character are rescued, as well as the relational dynamics that occur between the apprentice and his/her environment. For this theoretical construction, there is no objective reality independent of subjective experience which is unconnected to circumstances surrounding the individual. Hence the importance of self-organization processes, which nourish co-determined, enactive and emerging processes, as well as of life stories and their influences in shaping research. (Moraes; Valente, 2008, p. 23).

Objectivity and subjectivity are not mutually exclusive in research practice, but instead, complementary. This understanding arises from the principle of intersubjectivity. Therefore, the knowledge resulting from research is the result of processes that involve interpretation, creation, intuition, self-organization and co-determination, on the part of researcher in relation to research object. The research practice, understood as a system of a complex nature, is nourished by an ethical principle. Thus, the importance of using instruments such as Informed Consent (IC).

The cognitive operators of Edgar Morin's complex thoughts help us to understand the developmental processes of the investigative process. Moraes and Valente (2008) emphasize the following principles in their work: a) the systemic-organizational principle, which links the knowledge of the parties to the knowledge of the whole, integrating the analytical and synthetic dimensions; b) the holographic principle, which shows the paradox of complex systems; c) the retroactive principle, which breaks with linear causality due to self-regulatory processes in the entire system; d) the recursive principle, which represents the self-organization of the system, and is characterized by an evolutionary spiral; e) the dialogical principle that constitutes the operative form of complex thoughts. They also emphasize that, in order to "think well", especially in educational research, they would add other principles, among which, the ecological principle of action, by Edgar Morin, which incorporates uncertainty as a permanent category of scientific search.

Addressing the methodological dimension, Moraes and Valente (2008) note that method illuminates the path for a researcher, that requires action strategies and procedures adaptable to reality. It results that "[...] there is a recursive relationship between theory and method, between method and strategy. In this relation method is generated by theory which, at the same time, regenerates theory itself, as well as the

methodological strategies which regenerate the method which gave rise to them." (Moraes & Valente, 2008, p. 57). Based on these assumptions, it is possible to see that different methodological perspectives can be complementary for the study of certain problems. The problem that instigates this work enables two methodological movements: one theoretical and the other interpretive-analytical. They become complementary during the process of writing the thesis.

The researcher's responsible subversion actions "[...] arise from the challenge presented to them in multiple situations for which they do not find pre-established answers". (D'Ambrosio & Lopes, 2015, p. 4). In this bias, the principle of uncertainty and openness to the new is elucidated.

Creative insubordination is also inscribed in reflective actions, committed to the improvement of the investigative and human practices. D'Ambrosio (2016) recommends us to go beyond the space of cages by instigating us to break with closed rationality. In this perspective, D'Ambrosio (2016) considers that the ideal of respect, solidarity and cooperation among all individuals and nations demands transdisciplinarity and transculturality. When approaching life and the evolution of our species D'Ambrosio (2016, p. 230) uses the following metaphor: "I accept life as the conjunction of six elements: nature, individual, other(s) and the relationships between them". In this union, the activation of this "system" is given by a pulse of survival and transcendence, as a consequence, "[...] the homo species have developed the perception of past, present and future, and resources to explain their enchainment and to comprehend and explain facts and phenomena observed in nature and in society". (D'Ambrosio, 2016, p. 232). It is thus a process of human philosophy, which has been inspired by the searching for explanations for the knowledge of a social-planetary-cosmic reality in harmony with itself, with others and with nature. Moraes (2008) specifies that Böhr's principle of complementarity helps us to fully understand the triangle of life represented by D`Ambrosio (2016). This principle shows us the interdependence and complementarity between individual, society and species. It explains dependence on the environment (ecosystem) and the context in which someone lives.

In a panel at "The Second International Conference on Creative Insubordination in Mathematics Education" (ICOCIME2), Arthur Belford Powell (2019) suggests as themes to be subverted and decolonized the ontological and epistemological positions, as well as ways to search (ways of searching). Thus, precedents are opened to question rationality and reasonableness of science.

Edgar Morin (2014b) and Paul Feyerabend (2011), for presenting distinct but complementary epistemological bases, give a possible attempt at an answer to reflect on rationality and reasonableness in science. Morin (2014b) suggests that there are, in both science and philosophy, "the thinkers of science and the thinking scientists. On the other hand, Feyerabend (2011) proposes abandoning the boundary criteria between philosophy and science. In his work "Against Method" Feyerabend presents a direct criticism of rationalism translated by "uniqueness" of the method of science, which constitutes one of the founding ideas of his theory epistemological anarchism. He suggests that all rules have their limits and that there is no encompassing rationality. From that point of view, science is plural and dynamic (with irrational components) and there is no total separation between discovery and justification context.

Lopes, Peres and Grando (2017) consider that being subversively responsible is "[...] to take curiosity as basis for knowledge production and to make its unfinished a constant searching movement". (Lopes, Peres & Grando, 2017, p. 3). In other words, it is to perceive the temporariness of all knowledge,

assuming itself as being inconclusive.

Science announces the rise of new theories that express new epistemic configurations. Some of these are the studies on Heisenberg's quantum indeterminacy with his principle of Uncertainty, Böhr's Principle of Complementarity and the different levels of reality explained by Basarab Nicolescu. These theories largely converge in the theoretical construction of Edgar Morin's complex thought.

The principle of uncertainty originates in Werner Heisenberg's mathematical elaboration in addressing the behavior of particles. According to Santos:

> The concept of uncertainty contrasts with the dichotomized dualist messages, which only prioritize the dimension that adds to construction of order, of certainty, becoming a partial, reductionist, determinist and objectivist point of view. This is the concept spread by modern science and the scientific method of proving it. Considering the principle of complementarity of opposites, the articulation of dualities (in this case, certainty and uncertainty) necessarily comes into question, and not their dichotomization. (Santos, 2009, p.30).

As made explicit in previous studies, it is necessary to confront the complexity of reality, by awakening to a self-reflexive science and open rationality (Morin, 2014b). Therefore, "[...] open reason is not only method. It is an aptitude to elaborate systems of ideas, but systems that are not given as definitively fixed and that can be remodeled". (Morin, 2014b, p. 171). And, in turn, an evolutionary reason, with invariable characteristics.

knowledge derived from this research process is explained in the adopted method and theory. The complexity of this process can be represented in the form of a recursive circle, in which organized ideas become organizing ideas and conversely (Figure 1).
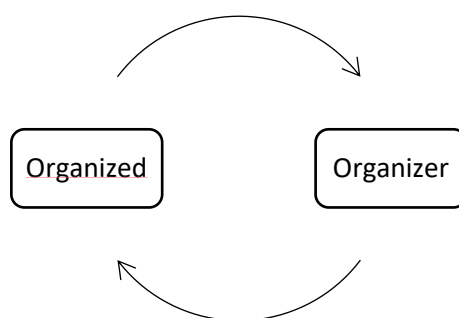

Figure 1. Knowledge organization adapted from Morin (2014b, pp. 136-137).

Morin (2014b) highlights that we find in ourselves, in the world and in life the key to complexity whereas the key to life's problem resides in the originality of the living organization.

It is thought some issues that guide the research in a transdisciplinary approach. The first question – to recognize oneself in the research process - directs us towards the self-knowledge/self-training that surrounds us. The second question - to meet again in time - reveals the relived memories and

self-reflection in our human constitution. The third question - to know the parts of a whole - is born from the understanding of the interrelationship part all in our species. The fourth question - life stories - comprises a dynamic system in which different participants and their stories interact. The fifth question - a story in formation - understands our history as a singular and emerging process. It is a moment of learning and education.

In this respect, a complex and transdisciplinary methodology is presented. But what is transdisciplinarity? Transdisciplinarity predicate an open rationality. For this, it was considered one of the articles adopted at the First World Congress on Transdisciplinarity (art. 2), since it contemplates the ontological process of research.

> Article 2 - The recognition of the existence of different reality levels, ruled by different logics is inherent to the transdisciplinary attitude. Any effort of reducing reality to a single level governed by a single logic is not in the field of transdisciplinarity (Charter of Transdisciplinarity, 1994).

It is brought the reflections of Guérios (2019), in an articulated manner, by presenting the corollary that it is not enough to know, it is necessary to think. It is thought this way from a complex and transdisciplinary perspective. To which degree do the different levels of reality translate the different dimensions of the trainer education? What does the existence of different levels of reality has to do with the process of knowledge construction? It is recognized a multidimensional reality that goes beyond classical thinking and that embraces the possibility of the existence of interconnections.

Moraes (2008) reflects about the multidimensionality of being and reality. According to him:

> Although there are different levels of reality, each phenomenon, event or process manifests itself from what the observer can perceive, interpret, construct, deconstruct or reconstruct. Such multidimensional reality can no longer be divided into organic and inorganic, into animated or non-animated, since the real is made up of dynamic beams of energy and standards of interconnections. Therefore, the capacity of perceiving each level of reality depends on the levels of perception of each observer and their developing consciousness (Moraes, 2008, p. 88).

In this regard, reality and the human being (part of this reality) operate from a complex engineering, disclosed in the representation of Figure 1. The human being is a complex, integral being, in whose dimensions of being and doing are mutually nourished by the act of thinking and acting. In this respect, being and reality would be irreducibly intertwined.

> The learner, in his/her relationships with reality, participates with all integrity, nourished by emotions, intuitions, desires and affections, which are inseparable from his/her life story. In one' s learning processes mind and body, reason,

emotion and intuition are no longer separated, as well as past, present and future. (Moraes, 2008, pp. 88-89).

Based on cognitive operators of complex thought, complexity and transdisciplinarity develop the epistemological scenario of the research. In this sense, the cognitive operators of complex thought help us to understand the complexity of reality. Transdisciplinarity as an epistemological principle makes it possible to experience dynamic and relational thinking seeking to overcome the frontiers of knowledge by integrating concepts and methods.

3.1 Data Description and Analysis

The early study of this research was a systematic review of key terms, which included: self-training; ecotraining or eco-training; self-eco-organization. This initial search was conducted in three databases: Education Resources Information Center (ERIC); Periodical Portal of the Coordination for the Improvement of Higher Education Personnel (CAPES) and Scientific Electronic Library Online (SciELO). A protocol designed for this work was used   for analyzing 39 documents that had been found. Afterwards, a new systematic review was developed in the database of the Brazilian Digital Library of Theses and Dissertations (BDTD), complementing the initial study. This allowed new analyses and the inclusion of 49 new documents. In in the second phase of this researchsanalyzed what had been produced by the graduate programs. There is a lack and/or invisibility of investigations in the field of teacher training during the search process when it is included the key terms elucidated in the different phases of the systematic review.

The ongoing theoretical study will enable a comprehension of the possible relationships between Pineau´s and Morin´s theories, and between the theory resulting from the empirical practices adopted in this research. The focus lies on the formation of the teacher trainer of teachers who instructs mathematics. The objective is to reveal possible dimensions of this formation. Therefore, Box 1 represents the principles of complex thought and their applications in the development of this research practice.

Table 1. Principles of complex thought adapted from Ribeiro & Moraes (2014, pp. 228-240)

Principles	Applications in Research
Organizational System	Research is a global unit structured by interrelationships.
Hologramatic	The hologram explains the interdependence between the investigated dimensions and the possibility of the interviewee to self-eco-organize, transcending factors attributed in isolation.
Retroactive	Existence of a complex logic.
Recursive	The dialogic exercise resulting from the research process synthesizes a new knowledge, a new reading of what is already known and what is already produced.
Self-eco-organization	Any production that results from a process of self-eco-organization results and happens as a co-emergence, noticed and welcomed by the to be/being.

Dialogue	In the logic of complexity there is complementarity and inclusion that links principles or notions that would commonly be excluded, but in the same reality, they are considered inseparable and irreducible.
Reinsertion of the Cognoscent individual	It rescues the human protagonism in the processes of construction, design and production.

The complex thought principles will underpin the interpretative analyses of data and the writings of research memos. The contributions of the present research to the field of mathematics education cover the theoretical and interpretative elements that result from a research procedure on the temporalities in the education of the teacher trainer. Recognizing this relational past-present movement, established in this formative process, may reveal possible dimensions of the education of the teacher trainer who teaches mathematics that add, beyond the present space-time, a past (re) signification. In this sense, the view is directed toward the formation of the teacher-trainer assuming the existence of a time that goes beyond us and that involves different formative natures. In this research it has been chosen to define these formative natures of dimensions that include elements which is particular of human specificity, the to be-being past-present.

4. Temporary Considerations

The initial theoretical premises of this research indicate possible learning dimensions of teacher trainer, as follows: a) the internal learning dimension (self-training); b) the external learning dimension (eco-training); c) the learning dimension of organizational formation (self-eco-organization). It was developed systematic studies on Gaston Pineau's tripolar education theory and Edgar Morin's complex thought to develop the theoretical assumptions.

Pineau (2003) builds the tripolar theory of education in a perspective of continuing education. He mentions eco-training in his studies, which is the most silent formation pole. This is one of the poles that it is aimed to emphasize in the research, integrating it with Morin's self-organization (2014a).

The core ideas derived from this relational and systematized study concentrate on the following reflective points for the teacher training field: a) self-eco-organization seen as an autonomous process dependent on the environment; b) self-learning perceived as a continuous and interdependent process between two temporal poles: self-training and eco-training.

Self-eco-training is what turns training into a complex system that integrates an internal learning dimension (self-training) and an external learning dimension (eco-training), from a continuous movement of self-eco-organization, which characterizes the autonomy and dependence of this system.

Self-training aims to understand the autonomisation of teacher trainers, which "[...] provokes a movement of personalisation, individualisation, subjectivation of training". (Pineau, 2003, p. 157). It is also understood that teacher trainers relate to others (heteroformation). Therefore, it is a permanent in movements in a relational system. Eco-training entails a reciprocity of training, because the environment, in its magnitude, shapes us. The need for forming a vital environment arises from this premise.

Morin (2011a) discusses eco-dimensions (from environment to ecosystem) by framing the principle of knowledge that can embrace life. "Cosmophysical cycles are within every living human being. And the eco-organization is characterized by building a polyrinth time". (Morin, 2011a, p. 43).

From this investigative process, in a complementary sense, the two research methods - oral history and grounded theory - allow a foretaste of the construction of a theory of the learning dimensions of teacher trainer of teachers who minister mathematics. The resulting key ideas come from a relational system and enable formative dialogues in the field of teacher training. This is the challenge!

The data derived from this research may reveal a formation movement of the teaching process of the teacher trainer who minister mathematics (the educational dimension), as well as the implicit or explicit educational movement of the environment about this process. It is also feasible to think how this movement self-eco-organizes itself in the environment, through and with the environment, in the interaction with itself, with others and with things.

It is fundamentally important to establish a relational dynamism between the data acquired with both oral history and grounded theory methods. The oral history method reveals the continuous past-presents and provides us with evidence of a training process. The grounded theory helps us to develop concepts, categories and a theorizing practice based on the elements obtained from the analyses of a textual body.

> The audacity of doing science may contribute to foster a human education that allows individuals to take social action based on solidarity and ethical values. Researches may serve a spiral movement, which allows for a reflection on what is set, a disruption with rules and norms, a free and creative search for other focuses, focuses and contexts. (Lopes; Peres & Grando, 2017, p. 3).

The aim here is to provide some challenges regarding creative insubordination in the process of research development. It is approached methods that complement each other in the process of research construction and that become "a path that is made in the journey". In this path, we create and insubordinate ourselves with pre-established ideas and pursue to make the new sprout.

7. References

[1] Ataide, Yara Dulce Bandeira de. (2006). História oral e construção da história de vida. In Souza, Elizeu Clementino de & Abrahão, Maria Helena Menna Barreto. (Orgs.). *Tempos, narrativas e ficções*: a invenção de si. Porto Alegre: EDIPUCRS/EDUNEB, pp. 313-324.

[2] Charmaz, Kathy. (2009). *A construção da teoria fundamentada*: guia prático para a análise qualitativa. Porto Alegre: Artmed.

[3] D'Ambrosio, Ubiratan. (2016). A Metáfora das Gaiolas Epistemológicas e uma Proposta Educacional. *Perspectivas da Educação Matemática*, Campo Grande, Vol. 9, No. 20, pp. 222-234, ago.

[4] D'Ambrosio, Beatriz Silva & Lopes, Celi Espasadin (2015). Insubordinação criativa: um convite à reinvenção do educador matemático. *Bolema*, Rio Claro, Vol. 29, No. 51, pp. 1-17, abr.

[5] Descartes, Rene. (1996). *Discurso do método*. São Paulo: Martins Fontes.

[6] Feyerabend, Paul. (2011). *Contra o método*. 2nd. ed. São Paulo: Editora UNESP.

[7] Freitas, Lima de, Morin, Edgar. & Nicolescu, Basarab. (1994). *Carta da transdisciplinaridade,*. available   online at:http://www.teses.usp.br/teses/disponiveis/39/39133/tde-21052012-093302/publico/ANEXOA_Carta_T ransdisciplinaridade.pdf

[8] Guérios, Ettiène Cordeiro. (2019). Contribuições do pensamento complexo para a formação de professores em uma perspectiva transdisciplinar. In Sá, Antunes de & Behrens, Marilda (Orgs.). Teoria da complexidade: contribuições epistemológicas e metodológicas para uma pedagogia complexa. Curitiba: Appris. pp. 223-236.

[9] Le Ven, Michel Marie; Faria, Erica de & Motta, Miriam Hermeto de Sá. (1997). História oral de vida: o instante da entrevista. In Simson, Olga Rodrigues de Moraes von (org). *Os desafios contemporâneos da história oral*. Campinas: Área de Publicações CMU/Unicamp, pp. 213-222.

[10] Lopes, Celi Espasandin; Peres, Gilmer Jacinto & Grando, Regina Célia (2017). Os percursos da insubordinação criativa nas pesquisas socializadas no ICOCIME1. *Revista de Ensino de Ciências e Matemática*, Cruzeiro do Sul, Vol. 8, No. 4, pp. 1-4.

[11] Meihy, José Carlos Sebe Bom & Holanda, Fabíola. (2007). *História oral:* como fazer, como pensar. São Paulo: Contexto.

[12] Montenegro, Antonio Torres. (1997). História oral e interdisciplinaridade: a invenção do olhar. In Simson, Olga Rodrigues de Moraes von (org). *Os desafios contemporâneos da história oral*. Campinas: Área de Publicações CMU/Unicamp, pp. 197-212.

[13] Moraes, Maria Cândida. (2008). *Ecologia dos saberes*: complexidade, transdisciplinaridade e educação. Novos fundamentos para iluminar novas práticas educacionais. São Paulo, Antakarana/WHH.

[14] Moraes, Maria Cândida & Valente, José Armando. (2008). *Como pesquisar em educação a partir da complexidade e da transdisciplinaridade?* São Paulo: Paulus.

[15] Morin, Edgar. (2014a). *Ciência com consciência*. Rio de Janeiro: Bertrand Brasil.

[16] Morin, Edgar. (2014b). *Meus filósofos*. 2nd. ed. Porto Alegre: Sulina.

[17] Morin, Edgar. (2011a). *O método II*: a vida da vida. Porto Alegre: Sulina.

[18] Morin, Edgar. (2011b). *O método IV:* as ideias – habitat, vida, costumes, organização. Porto Alegre: Sulina.

[19] Pineau, Gaston. (2006). As histórias de vida como artes formadoras da existência. In Souza, Elizeu Clementino de & Abrahão, Maria Helena Menna Barreto (Orgs.). *Tempos, narrativas e ficções:* a invenção de si. Porto Alegre: EDIPUCRS/EDUNEB. pp. 41-60.

[20] Pineau, Gaston. (2003). *Temporalidades na formação:* rumo a novos sincronizadores. São Paulo: Triom.

[21] Pineau, G. & Le Grand, Jean-Louis. (2012). *As histórias de vida*. Natal: EDUFRN.

[22] Ribeiro, Olzeni Costa & Moraes, Maria Cândida. (2014). *Criatividade em uma perspectiva transdisciplinar*: rompendo crenças, mitos e concepções. Brasília: Liber Livro.

[23] Santos, Akiko (2009). Complexidade e transdisciplinaridade em educação: cinco princípios para resgatar o elo perdido. In Santos, Akiko & Sommerman, Américo (Orgs). *Complexidade e transdisciplinaridade*: em busca da totalidade perdida. Porto Alegre: Sulina. pp. 15-38.