

Formal, non formal and other forms: physics class as discourse genre

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ABSTRACT

Researchers have emphasized the similarities and differences between formal and non formal education. These two concepts are different, requiring specific, initial and continued, teacher training for the ones who wish to follow the two concepts. Such training is possible for undergraduates who take activities, throughout the course, in museums and non formal education areas. Our goal in this article, which is part of a doctoral thesis, is to understand the benefits and obstacles created in the practice of teachers who work in these two training areas. Analysing the daily practice of a teacher trained in both formal and non formal education, a hybrid concept was identified, that we believe belongs to a particular discursive genre, different from both formal and non formal ways. Therefore, a theoretical framework based on the ideas of Mikhail Bakhtin, which allows us to think the class as a discourse genre, was outlined.

KEYWORDS

formal education; non formal education; physical teaching; gender discourse.

O FORMAL, O NÃO FORMAL E AS OUTRAS FORMAS: A AULA DE FÍSICA COMO GÊNERO DISCURSIVO

RESUMO

Pesquisas têm enfatizado aproximações e diferenças entre a educação formal e não formal. Podemos afirmar que os dois tipos de educação são diferentes, requerendo uma formação, inicial e continuada, diferenciada para professores que desejem transitar nos dois espaços de educação. Entendemos que tal formação é possível e é realidade para licenciandos que assumem atividades em espaços não formais ligados à educação. Nosso objetivo, neste artigo, o qual faz parte de uma tese de doutorado, é compreender benefícios e obstáculos gerados no cotidiano de professores que transitam nos dois âmbitos de formação. A partir da análise da prática de um professor que traz na bagagem essa formação diferenciada, gerando uma prática híbrida, percebemos uma *aula* que entendemos pertencer a um gênero discursivo específico, diferente do formal e do não formal. Para isso, esboçaremos um referencial baseado nas ideias de Mikhail Bakhtin que nos possibilite pensar a *aula* como gênero discursivo.

PALAVRAS-CHAVE

educação formal; educação não formal; ensino de física; gênero discursivo.

FORMAL, NO FORMAL Y OTRAS FORMAS: CLASE DE FISICA COMO GÉNERO DISCURSIVO

RESUMEN

Muchas investigaciones han puesto de relieve similitudes y diferencias entre la educación formal y no formal. Podemos decir que los dos tipos de educación son diferentes, lo que requiere de formación inicial y continuada, diferenciada para profesores que quieran transitar en estos espacios educativos. Entendemos que este tipo de formación es posible y es una realidad para estudiantes que asumen actividades en espacios no formales vinculados a la educación. Nuestro objetivo en este artículo, que hace parte de una tesis de doctorado, es entender los beneficios y obstáculos que se generan en la vida cotidiana de profesores que se mueven en los dos ámbitos de formación. Del análisis de la práctica de un maestro que trae consigo esta formación diferenciada, creando una práctica híbrida, notamos una forma de la clase que creemos pertenece a un género discursivo específico, diferente del formal y el no formal. Para ello, esbozaremos un marco teórico, basado en las ideas de Mikhail Bakhtin, que nos permita pensar la clase como un género discursivo.

PALABRAS CLAVE

educación formal; educación no formal; enseñanza de física; género discursivo.

INTRODUCTION

Many studies, such as those by Gohn (2010, 2011), Hartmann (2012) and Cazzelli and Coimbra (2013) have emphasized the similarities and differences between formal and non-formal science education. Formal education, as defined by Cazzelli and Coimbra (2013), is that offered in schools and has specific rules that define the content to be learned according to the curriculum. Non-formal science education is the responsibility of various institutions whose main goal is “to promote science and technology to a wide audience” (Hartmann, 2012, p. 89). With this in mind, we agree with the recognition that it is not only formal institutions that promote educational activities; nevertheless, there are marked differences in the activities promoted by formal and non-formal institutions. These differences include the desired objectives, the spaces where activities take place, the chronological sequences and, flexibility and adaptation of the curriculum according to the target audience.

Regarding the objectives, Gohn (2010) points out that teaching and learning in formal education originates from historically systematized and normatized contents. Non-formal education aims to enable individuals to become “citizens of the world, in the world” (*idem*, p. 19) and its objectives are constituted through interaction, thus creating an educational process. In addition, the goal of non-formal education is the transmission of updated information and political and sociocultural education.

According to Cazzelli and Coimbra (2013), formal education is interested in the direct measurement of learning, while non-formal education is interested in measuring the quality of the experience and its consequences.

Defined objectives exist for basic education, in a general way. According to Brazil’s National Education Guidelines and Framework law (*Lei de Diretrizes e Bases – LDB*), the goal is to form critical and active citizens and develop in them abilities and competences designed *a priori*. Article II of this law states:

The objective of education, which is the responsibility of both the family and the state, and is inspired by the principles of freedom and ideals of human solidarity, is the complete development of students, and their preparation to exercise citizenship and qualify them for work. (Brasil, 1996).

There are references in the academic literature (*Thesaurus Brasileiro da Educação apud* Hartmann, 2012) that characterize non-formal education as a complement to formal education. Nevertheless, there is no specific legislation for this kind of education, whereas formal education must meet methodological, legal and administrative requirements.

Until the 1980’s, non-formal education received little attention, and had minor importance in Brazil, in both public policies and for educators (Gohn, 2011). It began to gain visibility in the 1990’s due to changes in the economy and in the job market.

Group learning processes became emphasized and cultural values that articulate the actions of individuals received greater importance. A new organizational culture that, in general, requires the learning of extra school abilities, also began to be discussed. (*idem*, p. 100).

In this scenery, international agencies and organizations and even researchers have begun to participate in non-formal spaces, creating new educational possibilities (*idem*). One of the ways to integrate formal and non-formal spaces is to think about education as teaching and learning forms that take place throughout life and are not restricted to teacher-student relationships in classrooms. This perspective helps us reflect on the possibilities for an education truly focused on citizenship both inside and outside the classroom.

Considering relationships that can be constructed through similarities and differences, we can state that the interaction between formal and non-formal spaces can contribute to a more complex teacher education and to the expansion of the desired knowledge and of the objectivated knowledge and that put in daily practice. To think about this teacher education, we found support in one of the works by Queiroz *et al.* (2002), which refers to a study on human mediation in science and technology museums. In this study, the researchers reveal that “when reflexive-artist mediators, construct their knowledge of mediation,¹ they acquire a repertoire that can be accessed at any moment” (*idem*, p. 86).

Concerning the discussion about the education of mediator’s, Queiroz (2013) recognizes the importance of education based on solid scientific knowledge – which is focused on content, practical and based on specific competences, to allow the development of improvisation and the abilities needed to dialogue with science and the public – to generate self-confidence. Autor affirms that education for teachers who can work in non-formal educational spaces such as museums, since their first stage:

May lead those involved to experience the wealth of an educational situation that goes beyond school walls, and that this work is best resolved in the context of a partnership between museums and teacher education institutions. (*idem*, p. 11).

We can thus defend a position that values a dual formation for teaching practice – involving formal and non-formal spaces – given that both students in their basic education and teachers in their professional education reach the boundary of cultural diversity when they are in touch with both forms of education. This boundary makes encounters possible: encounters between perspectives, focuses and knowledge. We can say that the practice of teachers in formal education is different from the practice of teachers in non-formal educational spaces.

From this same perspective, which values this dual formation, Gohn (2011) emphasizes the need for a new school culture, to provide students with tools to

1 Mediation knowledge: a repertoire of theoretical and practical knowledge put in practice by mediators in situations of mediation in non-formal educational spaces.

interpret the world. He also affirms that the repertoire of knowledge that this new culture could offer has not been developed at schools. It could be attained by aggregating specific contents of non-formal education to what is taught at schools, “such as knowledge related to motivations, the social situation, the cultural origins of students, etc.” (*idem*, p. 25).

In relation to motivation, Queiroz *et al.* (2002, p. 78) affirm that:

In fact, non-formal education has its own characteristics regarding the autonomy of the visitor who is searching for knowledge, which favors cultural expansion and refinement in an environment that is able to stir emotions that become allied to cognitive processes imbued with an intrinsic motivation for learning sciences (Pozo e Gomez Crespo, 1998).

Returning to the discussion about teacher education, despite the valorization of non-formal educational spaces, teacher education focused on performing collectively in both spaces is still rare. Therefore, our goal is to contribute to the discussion about teacher education in formal and non-formal spaces for science education, by analyzing the practice of a teacher who, due to choices made during his initial education, experienced the intersection of these two cultures.² To begin our discussion, we use concepts from philosopher Mikhail Bakhtin to help us consider a physics class given by a teacher who experienced this encounter between the formal and the non-formal as a speech genre.

SPEECH GENRE

We will first outline a framework that allows us to think of the *class*³ as a speech genre (Goulart, 2008). To do so it is essential to select some concepts from Bakhtin’s work that will help us build a coherent framework, including utterance and chronotope, allied to speech genre.

UTTERANCE, CHRONOTOPE AND SPEECH GENRE

To understand the concept of speech genre, it is essential to understand the concept of utterance, which is conceived in Bakhtinian theory as a unit of verbal communication and signification. “Every utterance is a link in a very complexly organized chain of other utterances” (Bakhtin, 2011, p. 272). The listener who receives the utterance has an active responsive attitude – they can agree or disagree – “Every understanding of living speech, of the living utterance, is of an actively responsive nature [...]; every understanding is imbued with response and obligatorily generates it in one form or another: the listener becomes the speaker” (*idem*, p. 271).

2 Recognizing that culture is a broad concept, we begin with the idea of cultural dimension, “as processes of signification responsible for the meanings attributed to different social practices and that are objects of dispute in the field of discursivity” (Soares, 2011, p. 139).

3 We will use the word *class* in italics to characterize the “other form”.

Thus, utterances are understood as constructions that consider the listener (the addressee of the speech) to whom they are addressed – addressivity – and the context in which they are produced. Wertsch (1991, p. 13) shows us that “no utterance, and consequently, none of our actions, is found free of determinations that socio-cultural settings impose on us through the mediating instruments they provide”. Thus, every utterance is a dialogue and is part of an uninterrupted process of communication: “There are no isolated utterances, every utterance presumes its predecessors and all those that will follow: an utterance is only a link in a chain and can only be understood within this chain” (Jobim e Souza, 2001, p. 99-100). In other words, no text emerges from nothing, but always represents a response to other texts or to another reference universe it dialogues with.

It is also necessary to emphasize that each utterance possesses limits defined by the alternance of the speakers. Thus, when a speaker initiates an utterance, the other concludes it. This alternation of speakers and the limits of the utterances lead us to understand that a responsive attitude, whether active or passive, is associated to the utterance’s conclusibility.

Clark and Holquist (*apud* Wertsch, 1991, p. 71) point out a very relevant feature of the notion of utterance, which is voice, that is, speaking consciousness: “a spoken or a written utterance is always expressed from a point of view (a voice), which for Bakhtin is more of a process than a location”. Thus, there are no neutral utterances because they always express a worldview. Moreover, an utterance is composed of an extra-verbal component – a necessary constituent of its semantic structure (Amorim, 2006).

Bakhtin (2011, p. 261) also affirms that utterances:

reflect the specific conditions and goals of each referred field not only by their (thematic) content and linguistic style, that is, by the selection of lexical, phrasological and, grammatical resources of the language, but, above all, through their compositional construction (the way an utterance is built). All of these three elements – the thematic content, the style, the compositional structure – are indissolubly linked to the whole of the utterance and are equally determined by the specificity of a certain sphere of communication.

The sphere mentioned by Bakhtin is that of the use of language. Each sphere produces its relatively stable types of utterances, which are called speech genres.

The utterance thus reflects the specific conditions and objectives of each sphere of verbal communication through three aspects: the thematic content; the verbal style, which is associated to the selection of the resources of the language; and, above all, the compositional structure. According to Goulart (2008), the latter aspect is that which is most related to the formation of the speech genres.

Speech genres are relatively stable types of utterances developed in each sphere of human activity. Bakhtin points out the essential difference between primary (simple) and secondary (complex) speech genres. Primary speech genres are originated in everyday life, whereas secondary genres come from more complex, highly developed and organized conditions of cultural social conviviality.

It is known that every utterance is unique and thus reflects the speaker's individuality. Nevertheless, not all genres reflect this individuality in the language of the utterance since some speech genres require standardized forms. Therefore, physics education can be investigated by considering these assumptions. A class can be analyzed according to specific standards, and a teacher can be seen through a collective identity, that of the category of teachers. Nevertheless, both a class and a teacher must be understood from the perspective of individuality: an individual identity, a singularity that makes their practice unique and irreplaceable.

According to Bakhtin, genres are “relatively stable” standard forms of an utterance and are socio-historically determined. Furthermore, genres can vary to become adequate to social spheres and to the intentionality of the participants. Thus, the genres might interpose, alternate, or incorporate one another (Teixeira, 2012).

As Bakhtin (2011) states, utterances and speech genres are the transmission gears between the history of society and the history of language.

Regarding the second concept chosen – chronotope –, we can say that it marks the need to think about genre as a space-time construction. Moreover, the theory of the chronotope helps us to understand the connections of time and space relationships between speech genres since culture is an open unit, in constant transformation.

The concept of chronotope reflects the fact that two utterances might be distant from one another in time or space; and, when their meanings are confronted, they may reveal a dialogic relationship, be it between utterances of a real dialogue or in the wider context of the discourse of ideas created in distinct times and spaces. This concept, as emphasized by Amorim (2004, p. 223), reveals that there is always a place where “history unfolds, where time passes, where one lives and measures oneself based on the characteristics of this place”. Thus, the relationship between chronotope and speech production is essential and one must consider it in any analysis.

According to Machado (2005, p. 159), in the theory of dialogism, genres are inserted in the culture and manifest themselves as a “creative memory” and “constitute themselves from chronotopic situations”: for each sphere of human activity, the specificities involved lead to the employment of a typical set of utterances denominated speech genre. In physics, this idea is pertinent since various commonly used terms acquire different and well-defined meanings, creating obstacles for students in terms of language. Thus:

The wealth and diversity of speech genres are infinite because the possibilities of human activity, with its multiple forms, are inexhaustible and because each sphere of this activity has an integral repertoire of speech genres that grow and differentiate as a specific sphere develops and becomes more complex (Bakhtin, 2011, p. 262).

Therefore, we can say that, if the specificities involved lead to the employment of a speech genre for each sphere of human activity, formal science education and non-formal science education constitute two speech genres due to their specificities

and distinct activities. Our goal is to understand how these speech genres co-exist in the same space-time, thus constituting the *class* of a teacher, our research subject.

THE CLASS AS A GENRE: THE FORMAL, THE NON-FORMAL AND OTHER FORMS...

We begin with Goulart's (2008, p. 126) idea to reflect on the *class*:

What leads us to seek to understand how discursive interactions take place in the classroom is a certain set of theoretical foci of different origins, which have supported and defended the productivity of interactive classes. Even the tradition of school work, in the time-space called *class*, is organized in various forms of verbal interaction between teachers and students. According to Bakhtin, "every situation lastingly inscribed in social customs has an auditory that is organized in a specific way and, consequently, a particular repertoire of small current formulas".

We think that the way teachers organize themselves and organize interactions in specific spaces and in different times generates different forms of teaching and learning. But what do we understand by *class*? The characteristic forms of utterances produce "a particular repertoire of small current formulas" (Goulart, 2008, emphasis added). This repertoire organizes the speech and interaction in a class, which we understand goes beyond what takes place in a classroom, encompassing other moments with students at school, or in visits to other spaces.

The conditioning factors, that is, the aspects that influence a teacher's practice, such as the professional environment, students, the school structure and the school administration, comprise the complex context that influences the *class*. Moreover, teachers constantly re-adjust their goals according to the task that they are realizing and the temporal, social and material limitations. Their choices are based on issues that are inherent to the subject who makes them, such as the teacher's professional experience, their knowledge and beliefs, their commitment to their teaching, their representations of about their students and others. The current historical moment and the society in question also modify their goals.

A teacher's life story is another determining factor in their education and teaching practice, since the time when this profession is learned is not limited to the duration of their professional life, but includes their personal existence as well. In addition, "the production of meanings and senses of the teacher's daily practice is permeated by emotion" (Fiorentini; Souza Jr.; Melo, 1998, p. 322 *apud* Vilar, 2003, p. 31). The speech of teachers is imbued with feelings.

We cannot fail to mention the specificity of the field of knowledge that is addressed in the classroom. In the case of our study, the teacher's education was in physics. This means that his education required the use of utterances typical to this field. The class should thus be saturated with these utterances which require the students to appropriate new meanings.

Therefore, it is important to discuss that the understanding of an utterance is also influenced by the internally persuasive or authoritative aspect aggregated to it. As Goulart (2007) emphasizes, the authoritative word “does not need internal persuasion for consciousness, for we already find it associated to authority”. It is only necessary to recognize it and assimilate it. In the example above, we note the transmission of a point of view that rejects interanimation with other voices, those of the students’ (Wertsch, 1991).

Meanings are only understood when two (or more) voices enter in contact and when the words of the speaker’s utterance dialogue with the listener’s own words – *counter words*. As Bakhtin (2006, p. 137) explains:

Understanding is a form of dialogue; it is to the utterance as a reply is to the other in dialogue. To understand is to oppose the speaker’s word with a *counter word*.

If the listener does not have words in her repertoire that allow understanding of a certain utterance, the use of this utterance in further manifestations will become a speech act without intentionality or appropriation of the utterance.

In this way, we understand that the interweaving of factors that compose utterances in the *classroom* – the specific language of the field of knowledge, didactic proposals, transformation of the authoritative word into an internally persuasive word, hybrid speech, responsive utterances raised by teachers, students and textbooks, and everyday experiences, “in a hybridized entanglement of voices” (Goulart, 2008) – constitutes pedagogical utterances, and the *class* itself.

We call attention to the fact that we understand that a visit to a non-formal space for the promotion of science (or a visit of mediators to a school) is a contact with a genre that also implies communication and an attempt to learn scientific concepts, however, by using other strategies and mediations.

What we present in this article is thus a hybrid practice, a *class* that we understand belongs to a specific, particular genre, which is different from the traditional one, different from the formal and the non-formal.

METHODOLOGY

It is important to begin the methodological discussion by pointing out, once again, that this article is part of a doctoral thesis that counted on the participation of other subjects: the constituents – the high school students taught by the teacher; and the contributors – the undergraduate student teachers who conducted an internship at the school where this teacher works. In this article, our analysis is restricted only to the speech of the teacher – who is our main subject.

The need for a deep comprehension of the processes developed in the teacher’s daily practice, their motives, aspirations, beliefs, values, attitudes and influences, steered our focus to the discourse analysis of a single physics teacher concerning his teaching practice.

Understanding that teaching practice is a social practice, we must consider its social conditions of production: the complex and subjective character of the collected data required a qualitative research line, that is, “a research methodology that respects its nature” (Pérez Gómez, 1998, p. 99).

We must not forget that, in an interpretative approach, the entire research process is a social phenomenon that presupposes the existence of a complex interaction between the researcher and the investigated object – the subject’s speech.

Of the four types of qualitative studies considered by Ludke and André (2008) – ethnographic, case study, participant, and action research – our research is a case study. The object of study was specifically the hybrid practice of a physics teacher. According to Ludke and André, a case study “is realized in a natural situation, it is rich in descriptive data, it has an open and flexible plan and focuses on reality in a complex and contextualized way” (*idem*, p. 18).

THE SUBJECT

As Martins (2008) observes, every case is a case. In this research, we are interested in the case of the professional practice of a physics teacher, who received teacher accreditation in 2007 from a public university in Rio de Janeiro state, Brazil, and who is teaching at a public school in the state educational system of Rio de Janeiro. He also received a scholarship as a researcher and mediator at a science and technology museum. The teacher has a master’s degree in science education from a federal institution in Rio de Janeiro.

Considering all of the problems that are part of the context in which our subject is inserted, he considers himself to be a counter-hegemonic teacher who fights for the rights of students and public education. Why did we choose only one subject? Why did we choose this subject? We understand that based on our theoretical-methodological framework, we understand that a bibliographic review in our field indicates what is regular and constant. In this research, we seek to comprehend the unique, the singular, and at the same time, the possible. The analysis of a single main subject allowed us to take a deeper look at his practice, since we could also analyze based on other actors involved in the broader study – his high school students and undergraduate student teacher interns. As mentioned, we will only analyze the speech of the main subject.

DATA COLLECTION INSTRUMENTS

The data presented by this article is a selection from a vast repertoire of information collected during a doctoral study that used, besides interviews, a focus group, observation and an analysis of the master’s dissertation of our subject. We will present here only the data collected in the semi-structured interview – which was guided by previously prepared questions.

It is commonly known in the educational research field that a semi-structured interview is a “sequence of guiding questions that support the study’s interest” (Duarte, 2005, p. 66) to identify motivations, beliefs, perceptions and attitudes related to the object of investigation (Martins, 2008).

We understand in this study that the answers given by the teacher in the interviews are utterances from which were constructed what we call EPISODES. This concept of episodes refers to parts of speech that have clear boundaries in terms of referential semantic content or tasks that are developed (Mortimer; Massicame; Tiberghien, 2005), creating context for the emergence of determined meanings.

ANALYSIS

“WHO IS SPEAKING?”, “WHERE DO THEY SPEAK FROM?”, “WHAT IS THE EXTRAVERBAL CONTEXT?”. These questions are essential in an analysis organized according to the Bakhtinian perspective.

Our subject, as previously mentioned, is a high school teacher who works in the state educational system and holds a master degree from a federal institution. Since he is concerned about the social and political formation of his students, his motto is: *QUALITY AND DECENT PUBLIC SCHOOLS, FOR ALL*. This slogan is in all his e-mails. He also devoted himself to research at a science and technology museum. He considers himself a counter-hegemonic teacher who struggles for the rights of students and public schools.

Episode 1: The Practice

Concerning his practice, the teacher displays mastery of a vocabulary that is specific to academic research in physics education, and characterizes his practice by mentioning how he values his students' participation so that they can construct their own knowledge:

[...] through constructivism... constructivism is important to this... this issue of asking them questions, so they can reach the answer, it's not about just coming with everything ready for them... It's the theoretical basis that... that contributes mainly so I could also attain this way of giving classes, right? I think it has a little bit of everything [laughs], practice, theory, everything mixed... It's hard to separate, it's all together. [...] I try to ask my students many questions, right ... I never keep talking, talking, talking on and on because for me it doesn't work, to just keep talking... they won't absorb anything. I usually raise questions for them in the classroom, even as a type of challenge. [...] just to spark their curiosity...

It is possible to notice that this teacher defines some aspects of his *class*: constructivism, appreciation of an active role for students, questions as a didactic strategy and a relationship between theory and practice. The strategy of posing questions to students may indicate that our subject considers the possibility of modifying his classes based on the students' statements, indicating an attempt to achieve alterity. To exemplify the posture of appreciating the *other* – his students – in the construction of his practice, Francisco describes his attempts:

I try to innovate, innovating is not doing something differently for the sake of being different, it's about seeing what works and what doesn't. My innovation is closely based on what will work with my public of students.

This excerpt from the interview shows that his practice is modified by his public. The students have a central role in his decisions. In other words, one characteristic of his *class* is “non-rigidity”.

EPISODE 2: THE INITIAL TEACHER EDUCATION

At this point, he presents the contribution of the boundary as he refers to different voices – different points of view – of the various subjects who helped him become the teacher he is today. These subjects are representatives of both formal and non-formal institutions.

Of course, in the everyday interaction in scientific initiation (during his teaching accreditation course) with Professor C and Professor A⁴ and daily interaction with a technician,⁵ at the museum with the researcher⁶ who also conducts experiments, all of these things. And my contact with the museum itself. Because at the museum, we have this thing of not... not focusing on the content, but on the process of how it works; that is the main objective at the museum. I think so, right? I think it was basically this [...] totally [laughs]. I didn't want to teach before, before... having a good foundation at college. I think I did it right... when we begin teaching while we are still in college, we do what we learned in high school. It would be a totally traditional class. I wouldn't bring any experiment... and I would give extremely expositive classes... I think the biggest contribution came with my formation which was [...] to question the students questioning the students (right?), have them think a little, right? ... not just bring them prepared content, everything ready.

Teacher Francisco highlights his research experience during his scientific initiation, revealing the importance of this stage in his formation. In addition, he shows an appropriation of the speech from his university courses. We can infer that many voices compose the speech of this teacher since he refers to his professors, to a laboratory technician and a researcher from the museum, revealing the importance of the construction of knowledge in his initial teacher education. Moreover, he speaks about the everyday interaction at the science and technology museum where he was also an intern during college, showing an appreciation for low-cost experiments designed for the general public and the process of mediation developed and that is a counterpoint to a mere transmission of contents.

We may say that the baggage developed by Francisco in his initial education allowed him to understand the process he underwent and how much this initial education has influenced his identity and current practice – “to challenge the students, questioning the students (right?), have them think a little, right?... Not just bringing them prepared content, everything ready”. This education, which Queiroz (2013)

4 Trainer professors from the undergraduate course.

5 Technician from a didactic laboratory at the university.

6 Researcher from a Science and Technology Museum.

calls inter-institutional, leads us to believe in a deep and widened construction of knowledge, based on competencies and abilities to dialogue not only with science but also with students. This becomes more evident with the reflexive posture he has about the relationship between with his initial teacher education and his practice.

What stands out in this episode is Francisco's decision about when to begin teaching at high school, since he didn't teach before his graduation because, in his own words, he would not have been able to use these constructivist strategies that he now considers essential for the teaching and learning process. After his experience, he confirms that his choice was right – it worked. As Guimarães (2006, p. 47-48) points out, one must recognize that it is through the initial teacher education that we might find possibilities to begin the teaching practice “making it, in the context of other processes, into something that generates and articulates other aspects involved in professionalization”.

This way, the concept of chronotope is essential to understanding that Francisco perceives the possibility of constructing a new kind of class. His initial teacher education involved more than one educational space, more than one possible repertoire. Moreover, his determination when choosing the moment to begin teaching high school makes a difference in his speech about his own practice. The possibilities for acting in different space-times characterize his practice. We understand that his formation allows him to see the school from a different perspective that goes beyond the classroom and that leads him to realize that there is another kind of *class*, other ways to interact and develop arguments. It is no longer the formal or the non-formal, it is another form.

Episode 3: The counter-hegemonic practice

Here is an e-mail Francisco sent on April 2 with pictures taken at an event he organized at school.

I'm sending you pictures from the 2nd “The Museum goes to School” (the first event was called the 1st Fast Ice Cream), held on March, 31, 2011 at the state school. We held two simultaneous activities (besides, of course, teaching each of my classes): Cooking with Chemistry: Microwave Chocolate Mug Cake and Speak First: Astronomic Quiz. I'm very grateful for the collaboration, participation and affection of the student teachers.

I would like to thank the science education coordination department of the Science Museum for providing us with not just the interaction with such special co-workers but, moreover, friends and lovers of this profession (teacher-mediator). There are rumors that there were students who conducted both workshops at home with their families... They built terrariums... among other activities that we had done at school.

Our subject's attempt to make the school a pleasant environment for students and for the knowledge constructed be something meaningful in their lives is evident. For this purpose, he promoted pedagogical workshops to approach not

only physics contents but also contents from other school subjects. The realization of various pedagogical workshops – Cooking with Chemistry: Microwave Chocolate Mug Cake and Speak First: Astronomic Quiz – in Francisco’s practice features an initial motivation to implement a pedagogical project at school that establishes a bridge to connect formal education to non-formal education. It reveals the hybrid practice of our subject that originated from his differentiated formation that combined: university, museum and schools.

It is clear that Francisco’s *classes* go beyond the classroom and “occupy” the entire school space. We can say that Francisco’s strategies aim to respect the students’ curiosity, their aesthetic tastes, their questioning, their language (Freire, 1996). One can notice the dialogic aspect of our subject not only with the students who participate actively in the activities, but also with the other teachers, with whom he shares the process and results of his strategies, and with other educational professionals – student teachers from both the university and the museum. This dialogue reveals a search for a partnership between formal education – at the university/school – and non-formal education – at the school/museum –, something that was already part of his identity as a teacher and that we can call hybrid. This hybridism, although it suggests a certain homogeneity, is a result of a tension between the formal and non-formal cultures. We notice this in an analysis of Francisco’s characterization of his own professional identity, in the second interview:

I don’t know. It’s strange that... they have asked me what subject I really teach. Because the teacher wasn’t sure if I was really a physics teacher. She asked me, a teacher whom I’ve known for awhile, I work with her. She [said]: “Hey, after all, what subject do you teach? Biology? Art?” Because I don’t have a physics teacher’s identity. My idea is to work with a little bit of everything too. To bring everything I can to help in the classroom.

This utterance clearly marks the perspective of an educator who thinks about his practice considering broader objectives, who aims to work with contents that dialogue with his area of education so that his students might incorporate certain ways to build their knowledge from different areas.

He assimilates his identity based on his students’ needs to comprehend the knowledge he addresses in the classroom. It is in this sense that the tension is revealed, and that this hybridism is present in his identity and that we can say that his *class* is a particular genre.

EPISODE 4: POLITICAL FORMATION

In one of the classes Francisco gave during our field research we had the opportunity to see his action towards the political formation of his students. At that time, the school was undergoing a process of change in which a new principal was about to arrive at the institution. Francisco asked his students about what they would like to say to the new principal and for them to write on a sheet of paper some questions that would be shown to her. We asked Francisco about this process in the second interview:

The activity was that students should answer four questions: what they liked at school; what they didn't like at school; what the school should have and what it shouldn't have. Because we were passing through a moment in which the principal was about to leave but wouldn't leave, so it was a very complicated situation that interfered a lot with the beginning of the school year. So, we wanted to bring the students' opinions to the new principal, whoever it would be,,because we often know, we were once students, we remember that we were never asked about a change or implementation of anything inside the school. And this is very bad, it bothers the students [...] it is a moment I think for the students to learn how to participate in these discussions for the rest of their lives, right? Politically, the students learn, understand, interpret the difficulty that lies on the other side, but they also have to make demands of themselves, what they can do. I think it's about trying to share the responsibilities a little [...] they must learn how to have responsibilities and a way they can contribute, with a formal document, its very important for them...

Francisco returns, in his speech, to the moment in which he was a student to do things differently, to change his practice and the reality of his students. In other words, Francisco's critical attitude is not restricted to the discursive field, to a privileged place of generality; but it is put in action, in his unrepeatable acts, in the gaps existing that are generated by empty signifiers. As Lopes and Macedo (2011, p. 230) point out: "there are strong hegemonies, there are stable identifications that seem essential, but there is always a meaning that escapes control". Thus, Francisco considers it important to allow a critical formation, both for the present and future lives of his students: to empower them with responsibility so they can accomplish their tasks and fight for their rights. He also enunciates in his speech the ability to exercise *alterity* in two senses: to create a situation in which the students put themselves in someone else's place, seeing through the other's eyes – "*interpret the difficulty that lies on the other side*"; based on the students' educational needs, he modifies his practice towards a more complete formation.

Finally, he does not identify in this utterance a specific field of education in his own identity. To the contrary, he perceives his identity based on the students' needs to understand the content he presents in the classroom. This is how this tension is revealed, and this hybridism is present in his identity

FINAL CONSIDERATIONS

Our subject reveals his concerns about a teacher's identity based on innovative knowledge from the perspective of current research in both physics education and teacher education, in an effort to construct a constructivist repertoire. We highlight, in his repertoire, the importance of experimentation, of questioning and the role of students as protagonists in the construction of their knowledge. Francisco affirmed that he is in a development phase of knowledge about the teacher's experience, revealing a conflict with the contingencies of his profession – schools,

co-workers, contents, assessment, etc. Although he has knowledge about teaching that involves pedagogical innovation, which was constructed in his initial teacher education, Francisco finds difficulties outlining counter-hegemonic routes in his professional activity. We can infer, in his polyphonic⁷ speech – that by mentioning subjects who influenced him during his initial formation – that different voices compose the speech of this teacher who clearly dialogues with the courses of his initial teacher education – courses with a strong interaction between specific and pedagogical contents (Viana, 1992) – and with research in the scientific initiation conducted during his formation.

His emphasis on a dialogic posture in the classroom leads us to infer that Francisco gets involved in a dynamic and dialectic movement between doing and thinking, through which he reflects critically on his own practice. Thus, the dynamic between theory and practice appears in his speech about his classroom. It is exactly in this sense that we believe that Francisco, in his practice as a teacher, is able to see himself as an educator and to consciously conduct his practice on behalf of his objectives. We understand that his objectives are not set in stone, but they are adjusted and re-adjusted throughout his professional life and also according to his future choices.

Nevertheless, the process of seeing himself as an educator is complex, full of tensions. Thus, our subject presents himself as a teacher who lives with these tensions: the tension of a counter-hegemonic position; his belief in an education that goes beyond the mere transmission of contents (a traditional/mechanistic curriculum) but that permeates various dimensions of students as human beings, as dialogic beings that are collectively constituted; and the tension of his hybrid identity (hybridism as a form of knowledge) – a teacher who lives on the boundary inside the classroom, partially as a function of his formal and non-formal formation. This formation is essential for analyzing Francisco's practice, seeing the *class* as a speech genre, a genre that tries to subvert the traditional class, a genre characterized by the discursive and chronotopic conditions of our subject, a mixed and dialogical genre that meets not only the students' needs but also our subject's, a subject who is marked by tensions between himself and other educational spaces.

It is reasonable to suppose that Francisco's choices that led to his original approach would not be possible without a distinctive initial teacher education like the one he had, which combined the formal and the non-formal, based on a partnership between the museum and teacher education institutions, which had been developed since 1998 at the museum where Francisco worked as a mediator and researcher. This peculiar history of our subject allowed him to construct his own speech genre in the classroom, a real and alternative practice, which creates, a unique *class* of a unique teacher. This particular and singular speech genre associates

7 The concept of polyphony is found in Bakhtin's works in his analysis of Dostoevsky: "a plurality of independent and unmerged voices and consciousnesses, a genuine polyphony of fully valid voices [i.e., full of value, maintaining a relationship of equality with other voices of the speech as if they were participants of the grand dialogue] is in fact the chief characteristic of Dostoevsky's novels" (Bakhtin, 2010, p. 4).

the formal and the non-formal, producing what we call “another form”. This “other form” is concerned about the political, philosophical and pedagogical formation of his students, concerned with the questioning posture regarding school and life, concerned about the pleasure for learning and knowing.

We can say that what led us to comprehend Francisco’s *class* as another form was the opportunity to deeply study and analyze it, to understand the dimension of the influences present in his *class*: especially from non-formal education in formal space-time – the school.

We also understand that this other form is imbued with a political engagement and a particular optimistic desire for social change that begins at schools through QUALITY AND DECENT PUBLIC SCHOOLS, FOR ALL. It is important to highlight that this political engagement does not involve, in this research, engagement with a political party or a worker’s union, but reveals a more political educational practice, that is, a practice that creates pedagogical conditions for the students’ engagement and for the development of their critical citizenship through situations that lead students, as shown by Giroux (2003, p. 161), “to take risks, ask questions, challenge those who are in power, honor critical traditions and be reflexive about how authority is used inside the classroom or other pedagogical spaces”.

These considerations are relevant, once we understand that Francisco’s *class* is based on choices that value not only physics, but also invites teachers and researchers from other fields to jointly construct new paths for education. This philosophical aspect is noticeable by the fact that Francisco considers himself an educator and not only a physics teacher. Regarding the pedagogical dimension, we have emphasized that his practice, based on dialogism and an interanimation of voices, allows students, who question and are able to take a position, to be at the center of the teaching and learning process, and that the teacher, who sees himself as an educator and seeks to share his experiences with other subjects – students and teachers – to experience education.

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