SEVEN publicações acadêmicas

Teacher as a mediator in a high school community of practice that produces digital mathematical performance

https://doi.org/10.56238/chaandieducasc-031

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ABSTRACT

In this article, we discuss characteristics of the teacher's role and training based on a PhD research that investigated aspects/dimensions of how the negotiation of meanings occurs in a Group/Community, in which high school students produce digital mathematical performance (PMD). The Research is part of a mosaic of Researches of the Research Group on the Process of Teacher Training and Work of Mathematics Teachers. PMD is configured as the use of Arts and digital technologies (DT) in Mathematics Education, conceived as a didactic and pedagogical proposal, as an Active Methodology. Community of Practice is about the combination of a common domain of knowledge, a community of people who care about that domain, and a shared practice. We report part of a qualitative research, which used some concepts of Content Analysis and Arts-Based Research. The data were produced during the years 2018 and 2019, in a private school in Ribeirão Preto-SP. Participants created four PMDs in the two years of the Research, involving Function and Potentiation. The methodological procedures were field notes, PMD, Video recordings of classes and Semi-Structured Interviews. We investigated a pedagogical and multimodal environment that was configured in a different way from the traditional one, with an interaction between students and teacher, who acted as a mediator, providing the creation of an artistic and technological environment. In addition, in this interaction, we were able to perceive the interaction and sharing of concepts and practices, aspects that can lead to resignification in the teacher training process.

Keywords: Arts, Digital technologies, Teacher training.

1 INTRODUCTION

The Doctoral Research, partially reported here, is included in a mosaic (GREGORUTTI; FIRÃO; MISKULIN; SELIGARDI; MILAN; ABREU., 2022) of the Research Group in the process of training and teaching work of Mathematics teachers[i].

In our Doctoral Research (GREGORUTTI, 2022), we investigate aspects/dimensions of how the negotiation of meanings occurs in a group/community in which high school students produce Digital Mathematical Performance (DMP).

Particularly, in this article, we explore characteristics of the teacher as a mediator and his training in relation to this artistic and technological environment that, at times, has assumed some characteristics of Community of Practice.

Digital mathematical performance is conceptualized in this research as artistic and digital narratives of Mathematics. Specifically, we understand PMD as the process of communicating

Mathematics using the Performing Arts and as digital representations of these performances (GREGORUTTI, 2016; SCUCUGLIA, 2012).

Community of Practice (WENGER, 2001) It is made up of people who engage in a collective learning process. This Community has a shared domain for the actions and efforts of the participants.

We investigated, then, the teacher's mediation and the relationship with his training, based on the production process of four PMD, by high school students, from a private school in Ribeirão Preto-SP, throughout the years 2018 and 2019. In this way, we perceive the teacher as a mediator, providing the creation of an interactive, artistic and technological environment. In addition, in this interaction we were able to perceive the interaction and sharing of concepts and practices, important aspects that bring us the need to rethink a possible resignification in the process of teacher training.

1.1 DIGITAL MATHEMATICAL PERFORMANCE, COMMUNITY OF PRACTICE AND TEACHER EDUCATION

Made up of people engaged in a process of social, collective learning in a domain, who share: a concern, a goal or a passion for actions they do and learn, through an interaction, how to do these actions increasingly improved. This definition proposes, but does not intentionally assume, that learning may be the primary reason for a community to start, or that learning may be the incidental result of interaction between participants in a community (MISKULIN, 2010, p. 4).

The beginning of the conceptualization of the Community of Practice (CoP) was developed in dealing with situated learning and the socialization of knowledge in a CoP (MIST; SILVA; ROSA, 2006). Then, the concept was addressed, again by Wenger (2001), considering three dimensions – mutual commitment, joint action and shared repertoire (MIST; SILVA; ROSA, 2006). Finally, Wenger, McDermott and Snyder (2002) worked on the CoP with a definition related to informal groups.

The first concepts of CoP are related to the participation of members in a system of activity, in which participants share understandings and shared meanings coined in their lives and for their communities.

In the second understanding, for Wenger (2001), to be alive, to feel alive means to be frequently engaged in the search and in the process of achieving ventures of the most varied kinds. From the simplest, such as ensuring our physical survival, to the most advanced, such as the search for pleasures in a greater way. This search provokes interactions with other people and with the world, increasing our relationships as human beings. We can say that Wenger (2001) understands that this interaction provides a socially shared learning process.

In the third understanding, communities of practice are understood as the formation of people who engage in a collective learning process, based on a shared mastery of human effort. For example, a network of surgeons exploring new techniques (WENGER, 2015).

This domain is the link between the participants, the members of the Community. It takes place through the connection in a common interest and knowledge. That is, a subject that allows the formation of a possible determined identity in the interaction of some moments of this Community.

Wenger, McDermott and Snyder (2002) point out that mastery inspires community participants to contribute to it, to participate actively, guiding shared learning and attributing meaning to the actions established in that community.

Knowing the domain – its limits, its potentialities – allows members to determine what activities they will engage in and how they will do so. Without this commitment to the domain, the Community will become just a Group of Friends (BENITES-BONETTI, 2018; MENDES; MISKULIN, 2013; MISKULIN, 2010; ISKULIN; SILVA; ROSA, 2006; SILVA; SILVA; MISKULIN, 2010).

In the case of the Group/Community studied in the Doctoral Research, partially reported here, the domain was given by the mathematical concepts (placing the mats concepts) in an ENEM problem, such as potentiation and function, among others, studied during the production process of the PMD.

The Community is made up of a group of people who are concerned with the common domain. These members should help each other, share ideas, information, actions that allow for shared learning. The community will become CoP if participants interact and learn together (WENGER; MCDERMOTT; SNYDER, 2002). There needs to be a sense of belonging, of mutual commitment, among other aspects.

In the case of this research, the Community was formed by the teacher/researcher (author of the PhD research), by a group of high school students from a private school in Ribeirão Preto-SP and the life history of these people. Also, the place (the school) and its history and the interaction between all. The Group/Community was constituted in some moments of our interaction in this research.

Practice is not a simple "doing". It is a historical and social "doing" that gives meaning to what one is doing. It involves social living, participation recognized as participants in a given community and who create their own ways of "doing something" (WENGER, 2001).

The practice is formed by a repertoire of shared actions. Here we have the possibility of articulating common goals, dialogues, actions, reflections and collaboration (MISKULIN.; SILVA; ROSA, 2006). All these actions imply a way of learning and teaching.

In the case of the group analyzed in this research, the practice took place through the production of artistic videos of Mathematics, which we called PMD (FIGHT; SCUCUGLIA; GADANIDIS, 2014). That is, by actions shared in the High School Group/Community when producing PMD, which was composed of writing the script of the videos, producing, recording and editing the video. In addition to the Interviews and Questionnaires answered by some of the participants.

Joint action tends to maintain the Community. For this, a collective process of negotiation of meanings took place. This process involved the complexity of participants making a mutual commitment.

This community that produced PMD, involved an artistic, educational and technological environment. Arts and Mathematics have related in many ways throughout human history (ZALESKI FILHO, 2013).

The notion of digital mathematical performance emerged in 2006 (GADANIDIS; FIGHT, 2008), expanding the dialogic space between these fields in Mathematics Education (BORBA; SCUCUGLIA; GADANIDIS, 2014; GREGORUTTI, 2016). In this way, LDCs can take on various understandings. One of them brings PMD as a line of research in Mathematics Education that is in its initial phase of implementation (BORBA; SCUCUGLIA; GADANIDIS, 2014; SCUCUGLIA; GADANIDIS, 2013), with academic research in several areas.

Another understanding of PMD approaches PMD as multimodal narratives that aim to communicate mathematical ideas through artistic integration (BORBA; SCUCUGLIA; GADANIDIS, 2014).

Our focus will be on understanding that approaches LDCs as an Active Methodology (MISKULIN, 2020), with didactic and pedagogical possibilities, that is, as a methodological strategy of the work of the teaching action for teaching and learning of Mathematics, with integrated use of Arts and Digital Technologies in Mathematics Education.

The PMD tries to bring the knowledge of Aesthetics closer together, as it occurred in Ancient Greece (MARCONDES, 2001). The PMD aims, in this understanding of being Active Methodology (VALENTE, 2017), create an environment for students to actively participate from the beginning of the creation process, inspired by the Pedagogy of the Oppressed (FREIRE, 2011).

It is in this movement that the performative environment can assume, at times, some of the characteristics of Community of Practice (WENGER, 2001). However, for the scope of this article, we will focus on the relationship between teacher mediation and work with PMD.

In this environment, then, the teacher's mediation becomes much more complex. The teacher will not only be focused on transmitting knowledge, in the center of attention. The teacher will be more associated with guiding learning, helping students to create their learning projects.

From this perspective, teacher education needs to be discussed, since there is ample research on teacher education (MEGID, 2009), which alert to new teacher practices, especially teaching practice as a social practice (WENGER, 2001).

Corroborating this perspective, we have the research from our Teacher Education group (BENITES-MANTTI, 2018; MENDES, 2013; RICHIT, 2015; RODRIGUES, 2016) address the concept of Communities of Practice in the teacher training environment, in the educational context.

These researches used several aspects of the Community of Practice, socially shared learning as a very important aspect that emerges from a social practice in the process of teacher training.

Miskulin (2009) points out that technological development provides a new dimension to the educational process. The author points out that this development allows us to transcend outdated paradigms of the traditional model. The author also addresses the importance of teachers being prepared for these changes in order to make ICT an integral part of the student's reality.

Thus, she affirms the need for resizing in the conception of teacher training courses, conceptions that can transcend traditional training, which prioritizes teaching technique, to the detriment of a critical reflection on the use of technology in the educational process.

Javaroni and Zampieri (2015) also point to a resizing in teacher training for the use of DT. The authors also question whether schools would be prepared to support teachers in this regard:

The authors corroborated the research of authors such as Bridge (2014) that address initial teacher training dominated by specific contents, to the detriment of pedagogical knowledge.

However, both in this article and in the Thesis that generated it (GREGORUTTI, 2022), we do not assume fatalism (FREIRE, 2019). We seek to highlight dialogue in the classroom, teaching and active learning, detached from technicality. We see ourselves as beings in transformation, not adaptation. Thus, we think, according to Freire (2019), that teaching involves creating possibilities for students to develop their curiosity, trying to make it more critical.

And then, we ask ourselves: How is the teacher's mediation in the environment of mathematical performance production, which at times has assumed some characteristics of a Community of Practice? In this article, we seek to outline answers to this and other questions about the relationship between teacher training, performative and digital environment based on the analysis of the three PMDs produced in a private high school in Ribeirão Preto-SP, between the years 2018 and 2019.

2 METHODOLOGY

The Research Methodology communicated here was qualitative, with the use ofBased Research (FINLEY, 2005) and Content Analysis (BARDIN, 2011). Field Notes, Video Recordings of the classes, Interviews and the PMD, produced with the participants were the methodological instruments for the production of the data analyzed.

Four PMDs were produced throughout 2018 and 2019, in the High School of a private school in Ribeirão Preto-SP. The meetings in the two years had as a problem to be solved the following question of the National High School Exam (ENEM):

A city government is concerned about a possible epidemic of an infectious disease caused by bacteria. To decide what measures to take, you should calculate the speed at which the bacteria reproduces. In laboratory experiments of a bacterial culture, initially with 40,000 units, the formula for

the population was obtained: p(t) = where t is the time, in hours, and p(t) is the population, in thousands of bacteria. Regarding the initial amount of bacteria, after 20 min, the population will be40.2^{3t}

(a) reduced to one third.

(b) halved.

(c) reduced to two-thirds.

d) duplicate.

e) tripled.

Throughout the meetings, the students produced two videos, based on their parody of a funk song. The first video is a music video for the song called "Exponential of Bacteria". The second is an animation called "Exponential Bacteria":

In 2019, the students produced two videos throughout the meetings, based on their parody of a funk song. The first video is a music video of a parody of a Funk. The second, a recorded theater with the title "Bacteria in the Kingdom":

The classroom, in our view, was configured, during all the meetings, as a multimodal learning environment (WALSH, 2011), since, in all meetings, students could use projectors, laptops, colored pencils, crayons, costumes of various types (hats, wigs, makeup, clothes, etc.), musical instruments, chalkboards, among others. for the possible interaction between the participants, the teacher and the available material, arising, in some moments, the negotiation of meanings, through the PMD. In addition, the subjects of this research consist of thirty-three (33) high school students from the aforementioned school.

3 RESULTS AND DISCUSSIONS

And to be dialogical, for true humanism, is not to say that it is uncompromisingly dialogical; it is to experience dialogue. To be dialogical is not to invade, it is not to manipulate, it is not to "sloganize". To be dialogical is to commit oneself to a constant transformation of reality (FREIRE, 2017, p. 51).

We begin this section with a quote that addresses dialogue, understood as a constant transformation of reality (FREIRE, 2017). In our educational context, it is not a simple task for the teacher, students and school culture to work in a dialogical perspective, since we perceive the complexity pointed out by many authors, since teaching with traditional Pedagogy tends to persist (BRAZIL, 2018, 2020; FREIRE, 2016; SAVIANI, 2020).

Corroborating these authors, some of the participants in the production of PMD reported in this article point out that teaching is mechanical, technical, boring, and opposed to thinking:

Peter: In the basic part, it's mechanical. Knowing more, less, times, sharing, you take it for life, but it's very technical. I only learn how to perform a procedure. Not thinking. Log type. The procedure is quick, you don't think about what it is. It's very technical.

Mary: I think it's very boring. Those who do well in Mathematics are not those who think too much, they are those who use the techniques that Mathematics has. [...] It's very technical, more mechanical. Procedural.

If dialogue is one of the factors that will be one of the possibilities of teaching different from the traditional one, another aspect is the active participation of the students, with the mediation of the teacher (FREIRE, 2015; BRAVE; ALMEIDA; GERALDINI, 2017) in the educational process. Dialogue, mediation, and teacher are interrelated. Some demonstrations by students go in this direction:

Peter: And then we gave you a lot of ideas for that. We are the ones who created the lyrics. We took a cell phone to choose the song, listen to it and get the beat. And also to make the lyrics. To record we use the cell phone camera. Quite different from what the traditional classroom is.

Paulo: Because you [teacher/researcher] led the environment, created the environment and the people who participated. The room was very different. In a circle, chairs are set apart, with costumes. Various technologies available. And I think more conceptual. Because we think, we create.

So, active students, in a dialogic environment is a completely different characteristic for the teacher, accustomed to a more traditional environment, in which he is at the center of the educational process (FREIRE, 2011). The role of the teacher will transform it into a mediation for the creation of an environment with characteristics that provided the sharing of ideas and concepts among the participants. The teacher's mediation, then, becomes very important in this process (ROMANELLO, 2016; SILVA, 2018; BRAVE; ALMEIDA; GERALDINI, 2017), because, as already mentioned, the teacher becomes one of the participants in the learning group/community, mediating the process through a social practice (WENGER, 2001), where the participants participate and have the possibility to make rectifications on the mathematical, pedagogical and artistic concepts, worked on in this interaction.

The second characteristic with which the teacher's mediation could be transformed, in this interaction, with the theoretical and methodological perspectives of the authors mentioned above, would consist in the alteration of the traditional classroom, since there were "objects" different from those that are commonly found in the classrooms (BRAZIL, 2018; FREIRE, 2013; OECHSLER, 2018), such as costumes, technologies, musical instruments, among others. It is an environment format to highlight multimodality (WALSH, 2011)

Carolina: The room was different. In the face-to-face room, the room had different materials, with different desks. We used some things that we brought from home. There was a lot of different things in the room.

In addition, the layout of the classroom was in a different format than what is traditionally known, as the students were in a circle, with the chairs apart. The rows of desks gave way to a more open space, which allows the students' bodily performance, the uniform gave way to a more colorful environment, with costumes and props, among others.

This proposal, which was configured in a more dynamic way, also involved the technological aspect. In the process of creating this environment, the teacher used a larger space for visualization and experimentation by the students, whether recording or editing a video, composing a song, etc.

With this change in the teacher's mediation, in this interaction, emphasizing the dialogue, for the use of Arts and digital technologies, ceasing to be the center of knowledge transmission, it may lead to a transformation in the training of this teacher and these students, in the sense of a reification of pedagogical and mathematical concepts (WENGER, 2001)

Valente and Almeida (2020) point out that opportunities are needed for teachers to be able to use Digital Technologies in the classroom, to enhance new teaching practices. In addition, the use alone is not enough, as these teachers would need to pedagogically appropriate these technologies, to provide an improvement of the curriculum and an integration into the teaching and learning processes.

The authors also point out that Digital Technologies have not been appropriated by Education, at its different levels of education, as they have been implemented by the productive sectors, telecommunications, and the evolution of science. However, there are opportunities for the use of digital technologies in the teacher's practice, which we will show below, presenting some research.

This factor also appears in research on the use of digital technologies in Mathematics Education, since teacher training is dominated by specific contents, also to the detriment of technological knowledge (BENITES-BONETTI, 2018; CHINELLATO, 2016; ROMANELLO, 2016).

4 CONSIDERATIONS

Considering the thesis partially reported here, we point out that PMD as an Active Methodology (VALENTE; ALMEIDA; GERALDINI, 2017) It will contribute to the resizing of the teacher's role in the classroom.

First, in order for teachers to be prepared for these changes, it will also be necessary to transform teacher training. A training that will give greater prominence to pedagogical training.

The teacher will cease to be the center of knowledge transmission to a role of environment creator. It is the teacher who will create the environment that can enable interactivity, the sharing of ideas and the negotiation of meanings. We understand, then, that all the aspects/dimensions pointed

out in our Research (GREGORUTTI, 2022) are related to the teacher's didactic and pedagogical decisions. These choices also depend on the permission and guidance of the school's coordination and management.

The change will involve a teacher willing to create a different environment in terms of the physical layout of the classroom: from a more formal, rowed-up, gloomy space to a more open, colorful space, conducive to dialogue and interactions between students, which will promote students to the center of activities. The teacher will also leave the physical center of the classroom in many moments.

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