

RAMOS SYSTEM: METHOD FOR MULTIMODAL CAPTURE OF COLLABORATIVE WRITING PROCESSES IN PAIRS IN REAL TIME AND SPACE IN THE CLASSROOM

Eduardo CALIL*

- **ABSTRACT:** A large number of studies on real-time writing processes apply methods and techniques for data collection, under experimental methodological conditions. This article presents a multimodal capture system (visual, audio and written), which provides the researcher with simultaneous information of the writing process across the time and space of the classroom (ecological and didactic context). Visual recording is done through video cameras, capturing the context of the classroom and the interaction between students and teacher; audio recording is done through digital recorders and microphones, capturing the spontaneous speech of the writing process of students and the dialogue between the participants; the written registration is performed through smart pens and the HandSpy program, capturing the pen strokes on the sheet of paper. We describe each of these instruments, how they are used and the synchronization technique, generating a single media (film-synchronized). To illustrate how the Ramos System works, its importance and the advantages it offers to better understand the process of textual production (textual genesis) in didactic and ecological context, we present a qualitative and microgenetic analysis of pauses made by a pair of students (9 years old) while writing an invented story.
- **KEYWORDS:** Text Production. Collaborative Writing. Dialogue. Learning. Pause. Creativity. Authorship.

Introduction

One of the problems related to scientific research on writing processes is the way in which the term “process” is treated and the limits of information obtained through established methods and methodologies.¹ Regardless of the writing research conducted,

* Universidade Federal de Alagoas (UFAL), Laboratório do Manuscrito Escolar (LAME), Maceió – AL - Brazil. ORCID: 0000-0002-8696-3697. calil@cedu.ufal.br.

¹ According to Hyland (2016), the method corresponds to how data is collected. In the field of studies on writing processes, the researcher can collect interviews, questionnaires, make direct observation, record annotations in a field diary, use recorder or camera, use a computer program, smart pen, or collect a set of related texts to the writing process. The methodology refers to “the principles and understandings that guide and influence the choice and use of methods,

they all use tools, technical resources, and they define methodological designs to grasp the process by combining subprocesses or separating them to grasp specific aspects of the basic writing stages: planning, translation, and revision (HAYES; FLOWER, 1980). Methods and methodologies are necessary conditions for developing any empirical scientific research. Although they are different things, they are necessarily interdependent, linked to the theoretical perspective and objectives that involve the contextual and social aspects in which each study is inserted, regardless of the research framework carried out.

Notwithstanding their interdependent relationships, the investigations in this study field understand the process of writing as a cognitive and language action that is chronologically, chronometrically and recursively established in time, whose horizon is its product, that is, the text published or not, inscribed and linearized on a sheet of paper, on a computer screen or by any other means. From the point of view of the method to be used, access to the process can be obtained in two ways: off-line or *a posteriori* process and online or real-time process² (FOULIN; FAYOL, 1988; OLIVE; LEVY, 2002; FAVART; OLIVE, 2005; KNORR; HEINE; ENGBERG, 2014).

In the first access path, studies on the writing process are characterized by choosing methods to record products from the act of writing: materials related to what happened *before* or *after* the written piece³ under analysis was written. Perrin (2014) emphasizes that studies based on the comparison between products written to recover the process implement the “version analysis” as a method. The researches related to the field of Genetic Criticism (GRESILLON, 1985; BIASI, 2011) and textual genetics (FABRE, 1990; BORÉ, 2010) are representative of this method. Studies in Genetic Criticism choose “genetic dossiers” (letters, plans, drafts, manuscripts, versions, annotations, notes) as the study object. The investigations in Textual Genetics constitute the “school genetic dossiers”, composed of copies, recopies, school manuscripts (CALIL, 2008), produced in the classroom, under didactic conditions. All these products can map or contribute to the reconstruction of the genetic path⁴ of a text. Although the focus on the comparison between products allows tracing the transformations of linguistic,

such as experimentation or ethnography. The methods are the techniques used and developed, while the methodologies are the systematic application of these techniques” (HYLAND, 2016, p. 117).

² Since the terms “online” or “offline” used by authors such as Foulin & Fayol (1988), Favart & Olive (2005) or in the works published in Olive & Levy (2002) refer to a wide range of meanings, prevalently related to Internet uses, we will restrict its use to a much more specific sense, that is, to the “real time” of writing, without considering the meaning of “connectivity” associated with the term “online”.

³ We understand “written piece” as every textual product, fruit of the writing act, even if the result of this product was published or not, whether it is draft, manuscript, sketch, work or class notes, sparse annotations...

⁴ According to Biasi (2004), following the proposal of Bellemin-Noël (1977), the analysis of the genetic path of a literary work must take into account: i. the set of manuscripts of the “definitive” work (published or not); the work manuscripts (drafts, scripts, plans, notes), iii the “avant-text” (prototext), that is, the result of the analysis of the manuscripts, presenting the reconstitution of the genetic operations that precede the text. (BIASI, 2004, p. 43). These objects are part of the method proposed by Genetic Criticism for the analysis of literary manuscripts. The text genetics, when trying to trace the genetic path of school texts, has been limited to recover drafts, copies, recopies (FABRE, 1990; BORÉ, 2010) of texts written by students in the classroom. Through these products, generally considering the presence of erasures, the researchers seek to map the genetic path of these texts.

enunciative and intertextual relations, evidencing both the recursive and constructive nature of the act of writing a text, the limits of the written material are evident, as well as the analysis of versions in relation to the writing in real time and to the contextual and empirical evidences of the cognitive activity of the student writer during the writing process in progress.

The second access path to the writing process has been developed more recently, thanks to the current technological advances. The studies that take this path seek to recover, at least in part, the highly complex dimension involving the relations between the writer and the writing before, during and/or after the moment in which a text was produced. These technological advances have allowed the writing processes to be recorded through:

- Audio⁵ or video⁶ devices, often used to support the technique of verbal protocols (think aloud or retrospection protocols).⁷
- Computer programs, capturing keylogging recording⁸ activities or programs capable of screenshot recording.
- High-precision devices, such as eye tracking, associating eye movement with the movement of the digital pen on the display screen of a tablet (ALAMARGOT *et al.*, 2006).
- Smart ballpoint pens associated with software, such as HandSpy⁹ (MONTEIRO; LEAL, 2012), capturing every stroke and trace of the pen on the sheet of paper.

Such instruments have allowed capturing several phenomena related to real-time writing. Researchers in different fields of activity and different contexts (academic, professional, scholars), involving the participation of new or experienced writers, adopt or combine these methods¹⁰ to obtain evidences of pauses, hesitations, bursts, revisions, metalinguistic reflections related to the text in course or also to observe how social, contextual and pragmatic aspects interfere in the process of writing in real time.

⁵ Audio recordings were used as a method for recording “conversational essays” (GAULMYN, 1994). Two collective works, Gaulmyn, Bochar & Rabatel (2001) and Bouchard & Mondada (2005), bring different analyses of the Maité-Paulo corpus of two university students who talked while producing an argumentative text.

⁶ The study by Foulin & Fayol (1988) is one of the first ones to use video recording of real-time writing processes as a method.

⁷ The classic study by Hayes & Flower (1980) used as a method the audio recording of the verbal protocol of a single experienced writer while writing a text. This technique was widely used in the 1980s.

⁸ Among the many programs with this capability, we highlight Inputlog, Scriptlog and Translog. Simpler programs such as the Genesis du Texte (FOUCAMBERT, 1995) are used with students and in school contexts, but semi-experimental. For example, Doquet (2011) used this program in his research on real-time writing of 9-year-old students.

⁹ A more current version of HandSpy is in: http://docs.wixstatic.com/ugd/a36ba9_1f3fb53ae78941cb88cbf2043622bee9.pdf. Access on: 7 out. 2020.

¹⁰ In order to have an overview of some investigations combining different methods, we suggest consulting Olive & Levy (2002) and Heine, Knorr & Engberg (2014).

Despite the numerous instruments and methods developed to capture real-time writing, most of the studies assume an experimental and controlled approach, following the methodological rigors typical of laboratory studies. The advantages of this type of approach, especially related to repeatability and the volume of statistically significant information, face, as a counterpart, the artificiality imposed by these conditions of textual production for validating their findings in real and everyday writing situations. On the other hand, scientific works that seek to preserve real writing situations investigate the processes of experienced or professional, university student and adolescent writers. These writers have the skills and autonomy to use complex instruments, as they require a refined psychomotor domain to write, such as handling keyboards and monitoring the modifications produced on the computer screen or motor control skills for the proper use of digital pens on the computer surface of a tablet.

Few investigations can rigorously, precisely and spontaneously record what happens during textual production processes or what the writer is thinking when deciding to add or erase a linguistic element while writing the text in the natural and ecological context of the classroom. Even rarer is the multimodal and synchronic recording of student and teacher statements, of gestures and facial expressions, of the pen tracing over the paper, of the movement of other students, and of the classroom physical space. We can even say that if we consider such students, between 6 and 9 years of age, newly literate as writers, there seems to be no research on recording the writing process in real time and space in the classroom.¹¹

The objective of this paper is to present the Ramos System:¹² a new method built for multimodal, simultaneous and synchronous capture of the writing process in real time and space in the classroom. Firstly, we will describe the instruments, the proposal, and the technique used for the construction of the Ramos System. Next, we will present some findings and potentialities of this multimodal capture system, highlighting the occurrence of pauses during the text in progress.

Finally, several advantages of this proposal can be observed from an ecological and linguistic-enunciative approach assumed by the field of study in Textual Genetics, dedicated to understanding aspects related to the creation process, authorship, creativity and metalinguistic activities of these novice writers.

¹¹ In February 2018, during the European Literacy Network (ELN) Conference, funded by COST Action IS1401, The Digital Writing Support: Innovations in Technology Development and their Impact on our Understanding of Literacy was presented by Kaliopi Benetos (University of Essex), at the European Literacy Network (ELN) Conference, Otto Kruse (University of Applied Sciences Zurich). According to the authors' findings, none of the 44 technological innovations aimed at recording writing took into account the classroom as context and, in most of them, the didactic aspects are not explored.

¹² The name "Ramos" was given for two main reasons. The first one is a way of paying tribute to a great Brazilian writer, Graciliano Ramos, author of works that depict the Brazilian culture and, in particular, the State of Alagoas' culture. The symbolic meaning of this term also refers to the act of "ramifying", that is, something that is divided, multiplied from a starting point, propagating to different places and directions, so that its starting point is obliterated. We understand that the act of writing expresses this meaning by the fact that a text is the product of a process, constituted through its plans, scripts, schemas, drafts, manuscripts, versions, erasures, etc. We can also associate this with how scientific knowledge advances, through ramifications of ideas, techniques, methods, methodologies... These are the reasons for its name.

Ramos system: instruments, devices and supports

To be able to perform the multimodal capture of writing processes in real time and space, the Ramos System (RS) uses instruments and devices easily found in the electronic and audio-visual market. Its material basis is based on 3 types of media (visual, audio and writing), composed of the materials described below:

- **Media 1: visual recording**

The visual media is collected by handycam-type digital cameras (see Figure 1) attached to a 3-section articulated arm secured to a pressure clamp (see Figure 2). The clamp is attached to the worktable.

Figure 1 – Digital V550K Digital Camera. Full HD Panasonic.



Source: School Manuscript Lab.

Figure 2 – 196B-3 articulated arm and 035RL Manfrotto pressure clamp.



Source: School Manuscript Lab.

These cameras are positioned from two different planes. They are mainly responsible for documenting the films in the classroom in two focal plane frames: panoramic and focal.

- Panoramic plane: General camera, equipped with a wide-angle lens: camera positioned at the front of the classroom, usually secured to the teacher's desk; this camera records the movement of the teacher and students, as well as the physical and environmental characteristics of the classroom. We named the footage captured by this general-camera as "video-teacher".
- Focal plane: Camera-dyad equipped with standard lens: cameras positioned in front of the desk of each dyad of students; this camera records the face-to-face interaction of each dyad (dyad camera 1, dyad camera 2...), with a delimited

frame between students' faces and their desk. Each video captured by these cameras is called a "video-dyad".

These cameras also record the sounds in the classroom. Because they have an open microphone, they capture, without distinction, all the voices, sounds and noises of the classroom environment. To avoid using tripods and electric cables, which may get in the way and cause problems for student and teacher to move around, we decided to attach all video cameras to pressure clamps, and then attach the articulated arms to the desks of the students and teacher. Cameras run on long-life batteries instead of cables and wires.

Subsequently, in the post-collection treatment, the audios captured by these cameras will be replaced by the media audios 2, described below.

- **Media 2: audio recording**

The audio media has two connected instruments: digital recorder (see Figure 3) and lapel microphone (see Figure 4), both stereo. Their function is to capture, with quality, the speech of each of the participants. A digital recorder and a lapel microphone are attached to each student (audio-student) and also to the teacher (audio-teacher), allowing the accurate and faithful audible recording of the dialogues carried out between them, as well as the dialogue between the teacher and all students in the classroom.

Figure 3 – Tascam D5 Digital Recorder.



Source: School Manuscript Lab.

Figure 4 – Tie-Clip-Style Omnidirectional Sony ECM-CS10.



Source: School Manuscript Lab.

- **Media 3: written record**

The writing media associates a smart pen and a sheet of paper with lines and margins. These materials operate in an integrated manner. The smart pen, Livescribe, model Echo 2GB¹³ (see Figure 5), was chosen mainly for ergonomic and technical reasons. Because this was a ball-point pen, easy to handle and mastered by a young student, and used for writing on a A4 sheet paper (see Figure 6), was decisive for this choice.¹⁴ This type of smart pen has an infrared camera located at its lower end, capable of photographing each stroke of the pen on the sheet of paper in milliseconds. Associated with the HandSpy software,¹⁵ each stroke of the pen on the sheet of paper photographs the touched point and records it in an xml file. This file contains the information of the spatial and temporal coordinates of each photo, provided through a Dot Point System, printed on the sheet. The printing of this system can be done using a laser printer with a resolution quality equal to or greater than 600 dpi that supports the Adobe PostScript.

Figure 5 – Livescribe Echo 2GB smart pen with application HandSpy.



Source: School Manuscript Lab.

¹³ Available at: <https://www.livescribe.com/pt/smartpen/>. Access on: 7 out. 2020.

¹⁴ Before we chose the smart pens that write on a sheet of paper, we tested the digital pens that write on tablet screens. In these tests, we observed that 7-year-old students have great difficulties in using a digital pen on the surface of a tablet. These results are presented in the Writing Research Across Borders III (Paris, February 2014), under the title Ramos System: Evaluation of two devices for capturing real time multimodal writing in the classroom. In addition to the motor control difficulty to trace the letters and contain their stroke at the edge of the line, the response of the tablet to the touch of the pen on the screen was not immediate and sometimes did not capture the stroke of what had been written. In addition to these two aspects, the economic advantage favored our choice of this instrument, since the cost of a smart pen is significantly lower than the cost of a tablet and a digital pen.

¹⁵ This application was developed by the researchers of the University of Porto, under the coordination of Rui Alves, a collaborating partner in international cooperation work with Portugal. Alves provided the HandSpy and offered technical support for installing and using the smart pens. At the website <https://www.youtube.com/watch?v=OZ9LSBtgWl8>, the reader can find more detailed information about HandSpy and, the types of information provided by the application.

All the components comprising these three media are installed and connected in the classroom. With the sound support produced by the tapping of a clapper, we mark the beginning of the proposed textual production. The sound emitted by the clapper is captured by the audiovisual media and will serve as a zero point to synchronize these media with all other media and to time the time elapsed during the proposed textual production.

In order to preserve the ecological characteristics of the classroom, favoring the interaction between the teacher and students, the entire technical team composed of the researcher and his/her research assistants must leave the classroom. This simple procedure prevents students from making eye contact with researchers, interacting with them, asking questions about what they are writing, or asking for help to solve various problems or questions. The interaction between researchers and students mischaracterizes the natural environment of the classroom.

The physical characteristics of the instruments used also result in less intrusion and interference during the textual production proposal in the classroom, both in relation to the movement of the students and teacher, and in relation to recording the graphic-writing performed through the use of pen and sheet of paper. Our extensive experience with data collection through filming the text production proposals in the school context¹⁶ has shown that there is a strong tendency of participants, especially students, to “forget” they are being filmed acting, speaking, and interacting naturally and spontaneously, with their partners, colleagues and teacher. This aspect contributes to preserving the ecological conditions of the classroom and, above all, to characterizing the spontaneous speech that emerges in these interactive and dialogic situations.

Ramos System: installation, positioning and function of the media

The instruments described above are installed and positioned strategically for the most complete recording of the classroom environment.

Characterization of audiovisual media (media 1 and 2)

The role of this media is to register images with the movement of students and teacher. This registration takes place in two planes: the general plane of the classroom (video-teacher) and the specific plane of the pair of students (video-dyad); materials described above.

¹⁶ The film record of text production proposals in the classroom began on 03/17/1989 when we first recorded a proposal in which 6-year-old pairs of students had to write together a list of animals so that the name of each animal began with the letter drawn by the teacher. The material collected that year was part of the study “The Construction of Proximal Development Zones in a Pedagogical Context” (CALIL, 1991), and belongs to the collection of the School Manuscript Lab of the Federal University of Alagoas.

- **General plane, panoramic camera**

The camera with a wide-angle lens is the first to be positioned in front of the classroom and turned on.

Figure 7 – Image extracted from the video-teacher, showing the classroom of a fourth grade Portuguese school,¹⁷ 2017 (general-camera).



Source: School Manuscript Lab.

As it can be observed (see Figure 7), the general camera attached to the teacher's desk records the physical-spatial organization of the classroom environment (furniture layout, placards attached to walls, etc.), the position and movement of students and, mainly, the teacher's movement around the classroom. This allows the researcher to follow both the demands made by the students as well as the teacher's approximations and interactions with the whole class or with pairs of students.

In figure 7 we see the desks arranged in 3 rows and grouped two by two. There are 9 dyad cameras installed, 8 dyads and 1 student alone (on that day, his partner was absent). At the back of the classroom there is a cork panel and posters on the wall, and a cabinet to store the class material. With the exception of the student wearing a pink blouse, who has her arm raised, all other pairs and the student who is alone are writing. The teacher has her back to the general camera, positioned in the lower right corner of the video-teacher, from where her blond hair is seen.

¹⁷ Earlier versions of the Ramos System were used in data collection from Brazilian (2011, 2013), French (2014) and Portuguese (2015) schools. In this work we will use the images extracted from the collection carried out between January and March 2017, for the InterWriting/Dyad project. This international cooperation project, coordinated by the researcher Luísa Álvares Pereira, from the University of Aveiro, involves Portuguese and Brazilian researchers and the material collected compiles the collection of the School Manuscript Lab, where the data collected in previous years are also stored. We would like to thank all the Portuguese teachers, students and researchers, in particular, professor Luísa, without whom the Portuguese school collections would not have been possible. Procedures regarding ethical issues were followed and the authorization of all participants was obtained so that this collection could be carried out.

This film record captured by the general camera (video-teacher) will be added to each dyad to be synchronized later (2nd data collection stage). The video-teacher, by capturing the classroom environment, provides the researcher with complementary information to understand the interactional dynamics among the participants, such as displacements, body movements, gestures and directions of glances of students and teacher. Although this information is extremely relevant from the ecological point of view, they alone do not help to understand the writing process, much less how the teacher's interference has been established in this process. To say it more specifically, it is not possible to know what was already written when the student raised her hand to call the teacher, or whether her demand was related to what she still wanted to write. Through the video-teacher, the dialogue between this pair and the teacher is not audible.

- **Focal mode, dyad-camera**

After the general camera has been installed, the installation and activation of the cameras of the dyads begins. As we saw in Figure 7, we placed a dyad-camera for each dyad.

These cameras are attached to the top of the articulated arm. The lower part of this arm is attached to the pressure clamp which, in turn, is fastened to the top of the desk of each pair of students. The framing is adjusted so as to focus the two students, leaving a space in the frame above their heads so that we can later insert the video-teacher.

With this framework, it is possible to record, more accurately than the general camera, all the visual aspects of face-to-face interaction, such as the idiosyncratic expressive elements of each of the interlocutors (body movement, gestures, glances, facial expressions, position and pen position, position of the sheet of paper, etc.). It is also possible to record how each student engages, indicated by their glances and shared attention and other aspects related to the didactic and specific character of any didactic practice. Some of these aspects can be observed in Figure 8.

Figure 8 – Image extracted from the video-dyad, showing student C, responsible for writing the story, calling the teacher. (dyad-camera).



Source: School Manuscript Lab.

This image registers exactly the same moment represented in Figure 7, but from the point of view of the dyad-camera. Here, we have student C raising her hand and looking towards where the teacher was, who, seeing that she called her, walks towards the pair. The pen is in the student's right hand. Meanwhile, this student's partner, Student I, has his hand crossed, looking at his peer's raised arm. In the continuity of this image, shown by the synchronized film, we see the teacher walking up to the pair, to attend the request of the student who had raised her hand and is responsible for writing the story.

Regarding the school manuscript, on the student's desk, turned 45 degrees to the right in relation to her body, we have a little more visual information. It shows that by the time she raised her hand to call the teacher, she had already written on more than half the sheet of paper. But this information is still very imprecise to fully understand the writing process. It is not possible to know what was being written, how it was written, whether or not there were erasures or grammatical errors, as well as whether her request for the teacher was related to some orthographic difficulty or any other aspect related to the text in progress.

It is also not possible to access the audio captured by the dyad-cameras. The open microphone records all the sounds in the classroom, making the dialogue between the participants inaudible. This technical problem will only be solved with the digital recorders and lapel microphones.

- **Audio media: recorders and microphones**

After the cameras have been positioned and activated (general-camera and dyad-camera), we attached a digital recorder and a lapel microphone to each participant. Thus, we have the realistic record of each participant's speech (teacher and students) during

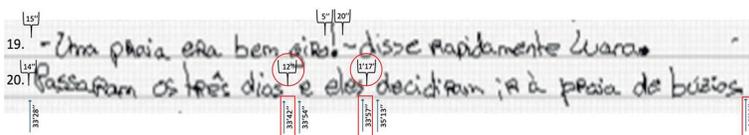
about the content of the fictional narrative, there are many other things that the product offers, such as number of words, number of lines, letters, words or phrases deleted, spelling or grammatical errors, punctuation problems, etc.

But it is not yet possible to know at what exact point of the manuscript in progress the student raised her arm to address the teacher.

When analyzing the xml file collected by the smart pen associated with HandSpy, we can identify the bursts, the short and long pauses that occurred while and after writing a word, or before the beginning of a sentence. For example, when extracting the pauses identified by the HandSpy program, there are 50 pauses, each of 5 seconds or more, during the writing of sheet 1 of this invented story. If we set as short pauses, those that last between 5 and 15 seconds, as average pauses, those between 16 and 30 seconds, and as long pauses, those with more than 30 seconds, we have the following distribution: 37 short pauses, 8 average pauses and 5 long pauses.

In Figure 8 it can be observed that the pause made by the student when raising her hand happened after half of the sheet was written, more or less, between lines 19 and 20. In these two lines we have the pauses indicated in Figure 10 below as follows: the keys mark the pause time; arrows indicate when a pause has begun and ended, setting the timing of the writing process since the beat of the clapping. We emphasize with rectangles the initial time of pauses and with circles the duration of the two pauses that we will discuss later.

Figure 10 – Lines 19 and 20 of the school manuscript generated by the XML file, with the respective pauses, marked by the HandSpy program.



Source: School Manuscript Lab.

Despite the timing accuracy offered by this program, the pauses do not report the relationship between the manuscript in progress and what was happening in the classroom. Between lines 19 and 20, 6 pauses can be identified: 3 pauses on line 19 and 3 pauses on line 20. The first 5 pauses were short and average pauses, occurring at the beginning or at the end of graphical or syntactic sentences. We still have a long pause (1'17") on line 20, between the subject "they" and the predicate "decided to go to the Búzios beach." We could suppose that the long pause may be associated with the moment when the student raised her hand, marking the time it took for the teacher to see the gesture of the student and go to help her. However, it is not known why the student raised her hand and, consequently, began this long pause during her writing flow.

HandSpy largely contributes as it maps the timing of the smart pen's touch on the sheet of paper, showing, for example, a tendency for the occurrences of longer

pauses between sentences. In an ecological context, however, when considering the ethnographic characteristics of each classroom, pauses and interruptions during a writing process may be associated with a variety of reasons, such as when someone enters the classroom class to give a message; a student makes a question about the spelling of a word; the writer stops writing to rest his/her hand. Hence, it becomes difficult to generalize the findings about writing processes recorded by the various collection methods used in laboratory or experimental conditions regarding what happens during writing processes in real life.

The great chronometric precision of the pauses, bursts, and the trace of the pen on the sheet of paper does not store information from the actual, everyday, and ordinary context of the textual production process in the classroom. It is precisely with the objective of being able to enrich the universe of studies on writing processes in real time and space that we propose the Ramos System, as it collects, gathers and synchronizes the information by these 3 media in a single study object: a synchronized-film.

Synchronized-film: multimodal, simultaneous and synchronous information

The Ramos System answers many of the questions posed above. After the data collection, the post-collection stage begins, when the synchronized film will be generated from all media collected (visual, audio and writing). The synchronized-film comes together from the following technical treatment.

Stage 1: Extraction, conversion and optimization of visual, sound and written media.

- Each of these media is processed according to the respective digital file types: mp4, mp3, png, jpg, pdf.

Stage 2: Inserting the media into the synchronized movie (this stage is far more time-consuming, requiring specific knowledge about video editing).

- The writing process of each of the participating dyads will be recorded in a multimodal mode and edited in a single movie.

The synchronized-film edition of each dyad considers:

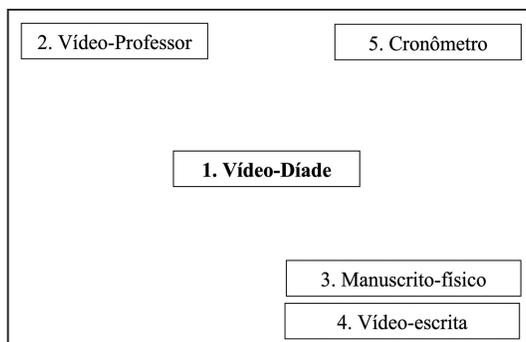
1. Video-dyad collected by the dyad-camera, filling the entire screen.
2. Video-teacher collected by the general-camera, filling the upper left corner.
3. Paper-manuscript, filling the lower right corner, positioned above the writing-video.
4. Video-writing collected by the smart pen and HandSpy, filling the lower right corner.
5. Chronometer positioned in the upper right corner.
6. Audio-student 1, audio-student 2 and audio-teacher.

Stage 3: Synchronization and editing of the synchronized-film.

- Synchronize, from the location of the sound produced by the clapboard, all audio and audiovisual media (video-dyad and video-teacher).
- Adjust the audio volume of the students of the filmed dyad and the teacher's audio and reduce the audio sound of the general camera media to make the audios of the two students of the dyad and the teacher clear and audible. Delete the audio captured by the dyad camera.
- Visually identify, in the writing-video, the first stroke of the pen on the sheet of paper and synchronize it with the video-dyad and video-teacher.
- Insert the paper-manuscript along with the writing-video when students begin to write the manuscript.
- The writing-video should be trimmed and should show the line being written.
- The paper-manuscript should be trimmed and should show the two lines: the previous line and the line being written. This way the researcher will be able to know what was written immediately before and immediately after what the writing-video is showing.
- Activate the chronometer after the clapper sound is identified.

Schematically, in the Figure 11, we will have the following layout of the audiovisual, visual media and the chronometer.

Figure 11 – Layout of the media in the synchronized-film by the Ramos System.



Source: School Manuscript Lab.

Specifically, when student C raises her hand, we have the image below:

Figure 12 – Image corresponding to 00:34:02:12 of the synchronized-film by the Ramos System.



Source: School Manuscript Lab.

This figure illustrates the information from the three synchronized media, at the precise moment student C raised her hand to call the teacher. We now know that the pause occurred at 34 minutes and 02 seconds, counted from the moment the clapper began. It is also evident that this pause occurred while student C wrote line 20. To be more precise, it occurred shortly after the word “they” and before writing the word “decided.” Now, the assumption made above has become evident: the 1’17” pause is associated with the moment the student raised her hand to call the teacher. It would then be necessary to ask what happened between student C, student I and the teacher during the time of this long pause.

Pauses and evidence of textual genesis in the ecological conditions of the classroom

The synchronized-film offers a wealth of material from which to analyze different aspects of the writing process in the classroom in real time and space. It offers, in a new and original manner, the accurate and precise capture, vast multimodal information of the audio, visual and writing quality of the act of writing a single text within a school context. This range of information is extremely important to understand the multimodal dimension of writing in progress in real situations.

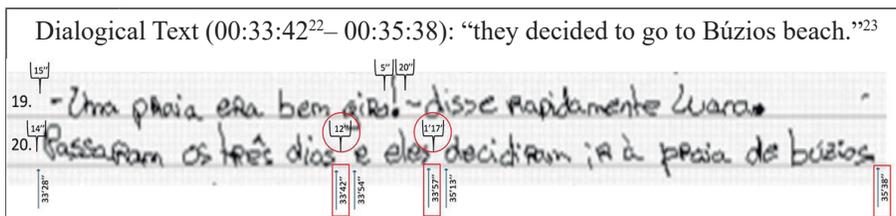
As we will show later, the Ramos System offers a wide range of interconnected information (pragmatic, linguistic, cognitive, interactional, didactic-curricular), in order to understand the genetic trajectory and textual construction and its relationship with teaching contents and student learning, as already analyzed in Calil (2013, 2016b, 2017).

In addition to the information presented above, through the synchronized-film we can access the transcribed verbatim dialogue,¹⁹ enriched with contextual and visual descriptions, allowing for, at least in part, retrieving the richness of audiovisual information related to the manuscript in progress. As the dialogical text extracted from the synchronized-film shows, the gesture of the student calling the teacher marks the beginning of a long pause, before the rest of the syntactic phrase²⁰ ‘they decided to go to the beach of Búzios’ is written. A brief analysis of this dialogical text (DT) can help present the potentialities of the Ramos System.

¹⁹ We will present this dialogue from what we have defined as dialogical text (CALIL, 2014, 2016a).

²⁰ In line 20 of the school manuscript we have a graphic phrase, identified by the capital letter and period, and two syntactic sentences, identified by the syntactic function: “. “The three days passed and they decided to go to Búzios beach”.

Figure 13 – Fragment of the manuscript “Really Nice Vacations”, lines 19 and 20.²¹



Source: School Manuscript Lab.

Time	Turn	Dialogical Text
00:33:42	1.	C* ²⁴ : (C finishing to write [days/eles ²³]. Her partner (I) says something unintelligible. C looking at I, responding emphatically, stops writing.) Do you think I know any beach in Brazil?
00:33:49	2.	I: Rio de... the one in Rio de Janeiro. (C shrugging her shoulders, expressing doubt about what her partner said.)
00:33:54 ²⁵	3.	C*: (Returning to writing [and they] on line 20.) ...and [and they/ e eles]. (C, at the end of writing [and they], she interrupts the writing, looks to the front and then at the teacher, raising her arm to address to her.)
00:34:02	4.	I: (Looking at the arm that C just raised and asking) Are we done yet?! (The teacher is standing, a little away from the pair, next to her desk, but looking towards these students.) When C calls her, she addresses them.)
00:34:05	5.	C*: (Teacher walks toward the pair. C lowers her arm, looking at the teacher, who is now bending over the desk of I.) Teacher, do you know any beach in Brazil?

²¹ In lines 19 and 20 this school manuscript is written:

19. - A beach was really nice! - Luana said quickly.

20. The three days passed and they decided to go to Buzios beach.

²² To make reading easier, we do not consider the hundredths of a second. We chose to round these values upwards, since they do not compromise the temporal rigor, nor the interpretation related to this aspect of the writing process.

²³ The name of a beach in Rio de Janeiro (Búzios) is the textual object recognized by students with a problem to be solved during the production of the invented story. This problem is of a lexical order, as defined in Calil (2017). It is the search for this term that interrupts the flow of linearization, the pauses and comments related to it. We highlight the comments in red, throughout this text-dialog. Microgenetic analysis aims to describe and explain its genesis, from an interactional and co-enunciative point of view.

²⁴ The asterisk indicates that C is the scribe.

²⁵ The brackets in yellow indicate what was entered (letter, word, punctuation mark, accent mark, erasure, etc.) as written by the student. The yellow block is intended to highlight the moment when this element was written on the sheet of paper. It is for this reason that the brackets can monitor what is being delivered, meaning that the student inscribed while talking. In this case, the C student finished writing “days” to 0:33:42 and wrote “and they”, to 0:33:54, starting the long pause as soon ended the inscription “and they”, to 00: 33:57. This time is also indicated by the arrow and red rectangle below the word “them”, in figure 13.

²⁶ The green block in chronometric time indicates the time and the turn in which the pause began. The red block, marked in the turn 28 and 29, indicates the end of the pause, when the student returned to writing the invented story, linearizing “they decided to go to Búzios beach”.

Time	Turn	Dialogical Text
00:34:08	6.	P: If I know any beach in Rio de Jan ... of ... Brazil?
00:34:12	7.	C*: (Nodding her head.) Yes.
00:34:13	8.	P: (Looking at C.) Fortaleza Beach ... beach of ... Porto de Galinhas ...
00:34:15	9.	C*: (Looking at Teacher.) Yeah ... but momentarily (sic) ... to make it sound great.
00:34:18	10.	P: Porto de Galinhas... there is the beach of Porto de Galinhas ... there is the beach of Fortaleza ...
00:34:23	11.	C*: Thank you.
00:34:24	12.	I: The one from Rio de Janeiro!
00:34:25 ²⁷	13.	P: The one from Rio de Janeiro!
	14.	C*: (Returning to what was written.) But they are real... they are...
00:34:26	15.	P: (Interrupting the student, speaking with emphasis, as if she remembered this beach.) Búzios! Búzios! Búzios beach, near Rio de Janeiro.
00:34:31	16.	C*: (Speaking of what the story they are writing is about.) I would like to talk about an... an adventure ... what we said... inventing the story... at the same time about our class...
	17.	I: ...the one of Vasco da Gama...
00:34:37	18.	C*: ...at the same time... about the teachers from Brazil...
	19.	P: (Surprise.) Ah!!
00:34:40	20.	I: (C speaking at the same time, but unintelligibly.) ... teacher... ... of... Vasco da Gama and Pedro Álvares Cabral.
00:34:41	21.	C*: (Saying that in the story one of the characters is a monster named Fatima, same name as the teacher.) And the teacher... The teacher is a monster. (Smiling and looking at the teacher.) Teacher Fatima is a monster.
00:34:46	22.	P: (Surprise.) Aah! (Laughing.)
00:34:47	23.	C*: (Pointing with the pen where it says what she said.) That's true. (Speaking as if she were reading.) Teacher Fatima is a monster.
00:34:50	24.	P: OK! (Returning to talking about Búzios.) It is so. Búzios ... is ... is ... is a part that has really small islands... and has beaches ... some beaches you can only go by boat. And they are... Búzios is a very nice area.
00:35:04	25.	C*: (Referring to what they have already written.) They have already spent an afternoon... 3 days... they already spent 3 days in Mélia!
00:35:08	26.	P: (Looking at C.) Wow !!
00:35:09	27.	C*: (Looking at teacher.) ... they are on vacation ... days of enjoyment...

²⁷ When the chronometric time corresponds to two or three turns it means that the speeches of the participants overlapped or were spoken simultaneously.

Time	Turn	Dialogical Text
00:35:13	28.	P: Ah... very well! (Turning and speaking to another pair.) Ready!
	29.	C*: (Returning to writing just after the word 'they'.) ... they decided ... [deci / deci] ... decided ... they de [cided / diram] ...
00:35:19	30.	I: (Trying to read what C is writing and returning to the suggestion given by the teacher.) ...the beach of Búzios.
00:35:20	31.	C*: (Writing.) ...go [go / ir]... to [tô / a]...
00:35:24	32.	P: (Voice off, addressing the pair) I'm curious, C and I...
00:35:25	33.	C*: (Writing.)... beach [beach / praia] ... [of / de] bu...
00:35:26	34.	P:(Voice-off, addressing the pair) ...to read what they wrote.
00:35:30	35.	I: (Dictating.)... búzios ... (C writing [búzios].)
00:35:31	36.	C*: ...'Búzios' is in lower case... (SI)
00:35:38		C*: (Writing the sign.) Period [!]

The DT extract of this writing process in real time and space, transcribed from the synchronized information offered by the video-teacher, video-student, audio-student, audio-teacher, video-writing and paper-manuscript is representative of the interactional dynamics of a classroom, and also allows a microgenetic analysis of the course of textual creation.²⁸

The teacher proposes a text production activity, the students concentrate, write, talk to each other, comment, ask questions, ask for help, whether they are in pairs or not. There is probably no classroom in which students do not do that, one way or another. If interaction and dialogue are intrinsic conditions for making proposals for the production of a text in the classroom, a teaching and learning social place, it seems only reasonable not seeking standards or regularizations related to writing processes and excluding these conditions. Just as we cannot ignore the pauses, hesitations, interruptions, resumptions, erasures in the writing process in real time.

In the case under discussion, we will highlight what happened between 33'42" to 35'38", when the pause mentioned above took place and the pair of students wrote "and they decided to go to Búzios beach." As we have seen, there were two pauses with more than 5 seconds. The first was a short, 12-second pause between "days" and "and." The second, a long pause of 1 minute and 17 seconds, between "they" and "decided." The school manuscript, of course, shows no pause or erasure in these two points, which could lead the reader of the manuscript to suppose an interruption in the

²⁸ According to what we have discussed in many of our works (CALIL, 2012; CALIL; AMORIM; LIRA, 2015; CALIL; PEREIRA, 2018 and others), the microgenetic analysis has a qualitative and co-enunciative character. From the perspective offered by Textual Genetics, within a linguistic-enunciative approach, this type of analysis traces the paths taken by the writers during the text in progress. This means that throughout the writing process, students identify and recognize certain textual objects, then they interrupt and return on what was or will be written in the text in progress. In the TD under discussion, we map what happened and what led students to write "decided to go to Búzios beach", highlighting, above all, the emergence and choice of the name of the Brazilian beach.

writing flow. On the other hand, any interpretations made from the chronometric time recorded by the smart pen about why these pauses occurred while writing line 20 could hardly estimate what actually happened when this syntactic sentence was linearized. To interpret, for example, that the first pause after “days” is related to some difficulty regarding the end of the sentence, when the student hesitates between the use of a period or the connective “and” seems mere speculation to us.

In the DT of this synchronized-film we have indisputable evidence that the two pauses are interconnected and are due to the same lexical/semantic problem, recognized by the students as the textual object to be written: the name of a Brazilian beach. The first pause of 12” is due to the recognition of this problem, right at the beginning of this dialogue-text, when writer C, after finishing writing “days,” at 00:33:42, interrupts her writing and she tells her partner that she doesn’t know a beach in Brazil. Even before her classmate’s suggestion (“the one in Rio de Janeiro”), C does not think it is a good suggestion, interrupting the pause at 00:33:54, and continuing to write the beginning of the next syntactic phrase: “and they,” whose registration and linearization lasted 3 seconds. That is, this short pause of 12’ does not indicate to have relation to the end of the phrase, ‘the three days have passed’.

After this moment, after writing this phrase “and they,” she again interrupts the writing flow, between 33’57” and 35’13”, characterizing the pause of 1’17”. In the meantime, she calls the teacher to ask if she knows the name of a Brazilian beach. Hence, this is important information to be added to the content of the invented story. Between the question asked to the teacher and the writing of the rest of the phrase, there is a short confusion between the name of a beach and the city where the beach is; there are brief comments on the content of the story, references to historical characters (Vasco da Gama, Pedro Álvares Cabral) and, particularly, a there is comment on the fact that one of the characters (monster) is the teacher herself. As it was said in the “metatextual commentary” (CALIL, 2017) of C, in turns 16, 18 and 21, the students try to mix, the teacher, the students on holiday and the teachers of Brazil in the fictional narrative. Among the names mentioned (Fortaleza beach, Porto de Galinhas, Rio de Janeiro, Búzios), “Búzios beach” was highlighted by the teacher (turn 15, at 00:34:26). The teacher then details some characteristics of the beaches (and small islands) of the city of Búzios (turn 24, at 00:34:50), which is the name chosen and written by the writer.

This brief microgenetic analysis of the DT not only does explain the two pauses recorded in the ecological and didactic context of the classroom, but also does the genesis of the term “Búzios” and why this was the name of the beach chosen by the writers, revealing that the beach at Búzios was not known to either of them. Its entry into the school manuscript and, therefore, into the genesis of textual creation, is directly associated with what the teacher suggested, from the question made by student C. From the genetic point of view, any of the names mentioned and suggested previously to the term “Búzios” could have entered the school manuscript. For this reason, we identify these occurrences as terms that compete after identifying a “point of tension” (CALIL, 2017) during the textual flow. At this point in the textual flow the student recognized

the name of a beach in Brazil as a “textual object.” From this point on, there was a series of “associative relations”²⁹ (CALIL, 2014) and “comments” (CALIL, 2016a), interconnected between the replicas of the DT. This phenomenon is related to the writing process by pairs in a school context and we call it “oral erasure”.³⁰

Conclusion

The fact of being in a school, inside the classroom, registering the didactic work within the discursive and social practices in which the main actors (students and teachers) are involved in the teaching and learning process, under conditions of daily and spontaneous interaction, brings our research closer to the ethnographic methodological characteristics described by Coulon (1995).

Although the analysis of collaborative writing processes in the school context has been a privileged scientific object for at least three decades (DAIUTE; DALTON, 1988; SWAIN; LAPKIN, 1998), there is no record of the use of technological resources similar to this one. No study has been identified in the literature which has developed a multimodal capture system similar to the one we developed.

The multimodal capture proposed by the Ramos System offers a simultaneous and synchronous volume of quantitative information related to the real-life writing process of the classroom. The articulation of multimodal information (visual, audio, facial expressions, gestures, body movements, positioning of the teacher and classmates, etc.) is very important to understand what happens during the writing process in the classroom.

Through this System, the material collected and edited can contribute to studies in different fields of knowledge, strengthening the interdisciplinary character of current studies in writing processes. Let us look at some questions, somehow interconnected, that are of interest to the study fields of Cognitive Psychology, Textual Genetics, Enunciation Linguistics and Didactics of Writing, whose synchronized-films allow exploring the following inquiries:

- How do students plan and combine an invented story? What are the relations between what was orally planned and what was actually written? How does the writing and linearization process take place and what is its relation to the on-line textual revision (which happens during the manuscript in progress)? How are the ideas created, and what is the role of co-enunciation, associative relations, working memory, and semantics? How are the burst and pauses during the real writing situations characterized? During the text in progress, what is the role of rereading and its relation to textual quality?

²⁹ It is worth mentioning that this concept has been interpreted from the proposal made by Suenaga (2005) on the Saussurean notion of “associative relation”. (SAUSSURE, 2001).

³⁰ A detailed description of how it works can be found in Calil (2016a, 2017).

- How does the textual genesis of texts in progress differentiate from and resemble to the teacher's instructions? What, for example, is the relationship between the title created and the story narrated? How are the characters created? How is the spoken discourse constructed and what changes when they are written? What do they say when they erase something? How do they erase some words? What kind of metalinguistic activity is associated with the erasures? How are the erasures in the dyads of students submitted to the same production proposals characterized and differentiated from different classrooms, schools and countries?
- How does the teacher's speech interfere with the textual genesis (how the proposal is presented, forms of intervention during and after production)? How does the teacher interact with the pairs, what aspects are important, what comments does she make about the story invented by the students? At what points do the students ask the teacher for help?
- How do they resume and use, during the manuscript in progress, the linguistic terms and contents taught?

Registering real didactic situations of text production in the classroom benefits improving our interpretation of the creation and textual construction, as well as the metalinguistic activities carried out by the writers during the text in progress. It also offers precise and precious indications of what is being written in a specific part of the sheet of paper, as well as what is happening when nothing is being written.

Notwithstanding the complexity of the collection, synchronization, transcription and quantitative-qualitative analyses that it generates, the richness of this system can significantly increase our knowledge about how our students think during their writing processes and how didactic practice can interfere and enhance the learning process of writing. With the Ramos System we can explore what they articulate spontaneously, one to the other or to the teacher, articulating this with the sociocultural, didactic and interactional context. Above all, we can establish correlations among spontaneous statements, teaching contents and the different types of problems identified and commented by the students during the manuscript in progress, evaluating the development of their metalinguistic and metatextual activities.

Unlike the investigations on the writing process that take the product (finished manuscript) as a study object or the audio record or the video record or the chronometric record of the different computer programs, what the Ramos System method proposes is innovative and original, not only because it offers a multimodal registration (visual, audio and writing), from the synchronization of different materials collected simultaneously, but mainly because it creates a new study object: the manuscript in progress in teaching-learning situations.

In summary, by gathering this set of multimodal information related to the process of collaborative writing in pairs, in the didactic and ecological context of the class, we highlight the following advantages:

- Preservation of the interactional dynamics of the classroom.
- Registering the dialogue between students and teacher, associated with the manuscript in progress.
- Registering spontaneous speech as a means of accessing what the student is thinking about the various linguistic and textual elements.
- Simultaneous recording of facial expressions and gestures, body movements, of what is being linearized or erased, of the (meta)linguistic reflections and what the teacher is saying to the students.

These advantages support the thorough distance between the writing process and what the finished text shows on its surface. Compared with what the Ramos System allows us to analyze, we can establish that the product is a pale reflection of the writing process in real time, created under didactic conditions. The invention of this new scientific research technique may promote significant advances in the study of writing processes in the classroom, contributing to our better understanding of the relationship between teaching and learning of written language. And, consequently, it contributes to improving the quality of the didactic practices related to the textual production in the classroom.

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CALIL, E. Sistema Ramos: método para captura multimodal de processos de escritura a dois no tempo e no espaço real da sala de aula. *Alfa*, São Paulo, v.64, 2020.

- *RESUMO: Um grande número de estudos sobre processos de escritura em tempo real usa métodos e técnicas para coleta de dados, sob condições metodológicas experimentais. Este artigo apresenta um sistema de captura multimodal (visual, sonora e escrita), capaz de oferecer ao pesquisador informações simultâneas do processo de escritura no tempo e espaço da sala de aula (contexto ecológico e didático). O registro visual é feito através de câmeras de vídeo,*

capturando o contexto da sala de aula e a interação entre alunos e professor; o registro sonoro é feito através de gravadores digitais e microfones, capturando a fala espontânea dos alunos escreventes e o diálogo entre os participantes; o registro escrito é feito através de uma caneta inteligente e do programa HandSpy, capturando o traço da tinta na folha de papel. Descrevemos cada um desses instrumentos, o modo como eles são utilizados e a técnica de sincronização, gerando uma única mídia (filme-sincronizado). Para ilustrar como funciona o Sistema Ramos, sua importância e as vantagens que oferece para entendermos melhor o processo de produção textual (gênese textual) em contexto didático e ecológico, apresentamos uma análise qualitativa e microgenética de pausas espontâneas feitas por uma dupla de alunos (9 anos) enquanto escrevia uma história inventada.

- **PALAVRAS-CHAVE:** Escrita colaborativa. Metodologia. Diálogo. Aprendizagem. Pausa. Criatividade. Autoria.

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