

Six Theoretical- Methodological Approaches to Analyze written texts in a Year-long Blended Learning Course

Seis enfoques te3rico-metodol3gicos para analizar textos escritos en un curso de aprendizaje combinado de un a1o



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Resumen

La interacción del entorno virtual ha sido estudiada desde diferentes enfoques teórico-metodológicos. El propósito de este artículo es describir las características de los textos escritos en un curso de aprendizaje combinado y analizar seis sistemas teóricos que los contrastan con los datos. Los datos recopilados son de todos los textos escritos en Moodle por el profesor en un curso de un año. Las variables se configuraron a partir de seis enfoques (sistemas de codificación): (a) - Comunidades de investigación; (b) - Dimensiones de la asistencia docente; (c) - Macro y micro-scripting; (d) - Doce formas de enseñar; (e) - Repensando la clase; y (f) - Registro de observación. Se realizaron análisis de fiabilidad y multivariados. Los resultados mostraron diferente consistencia de los enfoques. Los textos analizados revelaron cómo tuvo lugar la interacción y mostraron problemas pedagógicos subyacentes a las propuestas didácticas. Las asociaciones entre categorías produjeron tres grupos típicos de textos relacionados con las diferentes variables de los sistemas de codificación teórico-metodológicos utilizados: el grupo 1 reunió instrucciones generales; El cluster 2 ilustra el uso del entorno virtual como repositorio; y Cluster 3 representó la interactividad tutorial. Los estudios futuros deben continuar explorando estos enfoques, contrastándolos con datos nuevos, y viceversa, para obtener una mejor comprensión de la interacción sociocognitiva entre estudiantes y maestros en el aprendizaje combinado.

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Abstract

Virtual environment interaction has been studied from different theoretical-methodological approaches. The purpose of this paper is to describe the characteristics of written texts in a blended learning course, and to analyze six theoretical systems that contrast them with data. The collected data come from all the texts written in Moodle by the teacher in a year-long course. The variables were set up from six approaches (coding systems): (a)- Communities of inquiry; (b)- Teaching assistance dimensions; (c)- Macro and micro-scripting; (d)- Twelve ways of teaching; (e)- Rethinking the class; and (f)- Observation record. Reliability and multivariable analyses were carried out. Results showed different consistency of approaches. The analyzed texts revealed how interaction took place and showed pedagogical issues underlying the didactic proposals. Associations among categories produced three typical groups of texts related with the different variables from theoretical-methodological coding systems used: Cluster 1 gathered general instructions; Cluster 2 illustrated the virtual environment usage as repository; and Cluster 3 represented tutorial interactivity. Future studies should continue to explore these approaches, contrasting them with new data -and vice versa- to get a better understanding of socio-cognitive interaction among students and teachers in blended learning.

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Introduction

The combination of face-to-face and mediated interaction in Argentina, especially at local universities in Rosario, is increasing; nevertheless, it has had a slow development in comparison to other countries. How interactions take place in digital environments and their specific characteristics when those interactions are combined with traditional lectures remain scarcely described in the local context.

The main disciplinary relevance of this study, regarding Educational Psychology, is the concern on processes instead of the classic focus on learning as a product. Analyzing a case, as paradigmatic and heuristic at the same time, presents ways to observe real dialogue between students and teachers using available technology. According to the description provided by [Copertari, Sgreccia, & Fantasía \(2017\)](#), the virtual environment utilized in the main local public university is an open, flexible, and dynamic space suitable for the integration of virtual modalities with face-to-face courses. Although some colleges at the local public national university are precursors in incorporating virtual environments in teaching practices, it is still not widespread in some other academic communities with a predominant number of teachers who have never used virtual environments ([Borgobello, Mandolesi, Espinosa, & Sartori, 2019](#)). Analyzing research data on this topic, concurring with dialogue on consolidated theoretical-methodological research approaches, could help to comprehend the local scenario and to expand the exchange of experiences, productions, and knowledge.

Incorporating Charbonneau Gowdy (2017)'s ideas as our own, this paper posits that the research on learning supported by technology processes, in order to understand their growing complexities, has profound implications. Following Twining, Heller, Nussbaum, & Tsai (2017) notions, the line of research of this paper adopts qualitative methodology with the use of numerical information and inductive reasoning starting with the data. The scientific relevance of this specific paper is the creativity and possibility to go back and forth to analytical systems that have been previously constructed; integrating elements developed in another epistemological framework and reinterpreting them according to data. Briefly, this research line foundations focuses on thinking a case to rethink the university, and thinking the university to rethink a case.

One inspiring concept in this research project was scripting on blended learning courses. For Villasclaras Fernández, Hernández Leo, Asensio Pérez, & Dimitriadis (2013), scripts –specifically collaboration scripts- describe tasks, activities, and interactions expected from participants. Students remark scaffolding processes as a guide to plan learning from collaboration scripts. Nevertheless, to analyze the activities when teachers scaffold students in virtual interactions, all texts written by them should be considered as part of the entire learning experience, even when they are not scaffolding students directly.

Boelens, De Wever, & Voet (2017), based on well-known authors, summed up the concept of blended learning characterizing it as deliberate hybridization of online and face-to-face instructional activities. For the authors, the combination is not new, but since the rise of ICT (information and communication technologies), this approach has been implemented and studied repeatedly, offering several new opportunities for optimizing learning processes. This way of teaching and learning implies a redefinition of instruction, in which technology simplifies the instructional designed activities. Blended learning should be studied, revised, and distinguished from other ways of teaching delivery, looking for an instructional design based on convergence (Turpo Gebera, 2014).

The case under analyses in this paper was a social science course taught at a public national university in Argentina. All the texts written by the main teacher in a Moodle platform in a year-long blended course were analyzed.

Questions on which the research was based are presented below. On one hand, some philosophical questions about the research line were described. On the other hand, the particular questions that guided this specific paper were defined to organize the data analyses.

1.1 Some “philosophical” questions guiding the research line

How to think about and choose theoretical-methodological tools from literature to analyze the interactions proposed by teachers in virtual environments?

How can written texts characterize interactions between teachers and students within blended learning courses with mainly face-to-face interactions?

Research questions in this study

Which theoretical-methodological approaches are more consistent according to the data under analysis?

Which characteristics do the written texts in the virtual environment have in a blended learning design?

Which categories under analysis are more related to each other in the constitution of typical groups of texts?

Summarizing, the main aim of this paper is to describe the characteristics of texts written by a teacher in a virtual environment with blended learning design during a year-long social sciences course. Besides this, a methodological aim was present throughout the process: to analyze approaches or systems themselves as theoretical ways of thinking data. Then, the analyses were implemented considering data and relationships among categories at the same time.

Theoretical Framework

The use of several systems or approaches for analyzing teacher-student interactions in blended learning present the advantage of thinking, observing, and comprehending those interactions in different ways. Six systems designed as theoretical and empirical ways of thinking the teaching processes were selected from literature looking for some diversity. The systems chosen were applied in a dynamic way. In spite of the number of categories belonging to each approach, the interaction between them gave particular ways to observe data. Three of them were thought to analyze mediated interactions (Teaching assistance dimensions; Communities of inquiry; and Macro versus micro-scripting), and the other three were theorized or designed specifically to understand face-to-face interaction (Twelve ways of teaching; Rethinking the class; and Observation record). The research lines and the concepts are not widely explained due to the available space, but an explanation following the main characteristics and figures with the categories of each system is presented to make the data analysis understandable.

Communities of inquiry

Garrison, Anderson, & Archer (2000) who focused on online interaction, provided a well-known conceptual tool to analyze communities of inquiry. In this approach, the three essential elements used to study educational transactions were cognitive, social, and teaching presence: cognitive presence includes a triggering event, integration, or exploration about ongoing or new ideas; social presence refers to emotional expressions, collaboration encouragement, and group cohesion; and teaching presence implies the instructional management and direct instructions, such as bringing students to focus on something. Students who access the platform more frequently to check forums and make contributions were efficient teacher presence carriers, in other words, it is a non-exclusive teacher characteristic (Obando Correal, Palechor Ocampo, & Arana Hernández, 2018). Nonetheless, teachers are usually the main contributors in mediated instruction (Borgobello, Sartori, & Roselli, 2016).

Following the suggestion given by the authors to use their template (Figure 1) to assess different educational models in facilitating a community of inquiry, their approach was used as a trigger in this research. It has been refined since this framework was published in 2000; nevertheless, the construct has proven to be relatively stable, shifting to a broader perspective of online learning (Garrison, Anderson, & Archer, 2010).

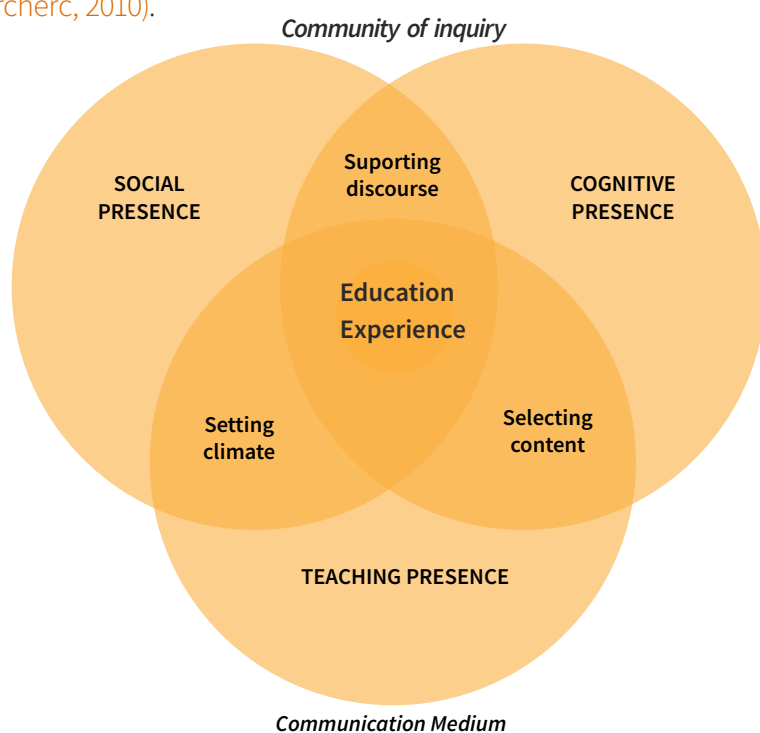


Figure 1. Col framework, elements of educational experience (Garrison, Anderson, & Archer, 2000, pág. 88).

Teaching assistance dimensions

While the approach designed by Garrison, Anderson, & Archer (2000) focuses on communities of inquiry, the system created by Onrubia & Engel (2012) takes as its main concept teaching assistance. In this system, the temporal dimension and the directionality of the posting become relevant.

According to Onrubia & Engel (2012), recent proposals on computer supported collaborative learning (CSCL) research, the base of their work, have suggested scripts as a key factor to educational effectiveness. They described scripts as teacher ability to adapt pedagogical activities to the students and to specific educational scenarios.

Participants in non-synchronic networks, by guiding the process of meaning construction and attribution of meaning, become carriers and agents of educational influence (Coll Salvador, Bustos Sánchez, & Engel Rocamora, 2011), nevertheless should be favored by the professor. Onrubia & Engel (2012) presented a multiple-case study to identify patterns of teacher assistance along with collaborative work developed by groups. They identified types of patterns related to different forms of collaborative work. The teaching assistance dimensions used by the authors were: recipient, moment, root, and task directions (see Figure 2).

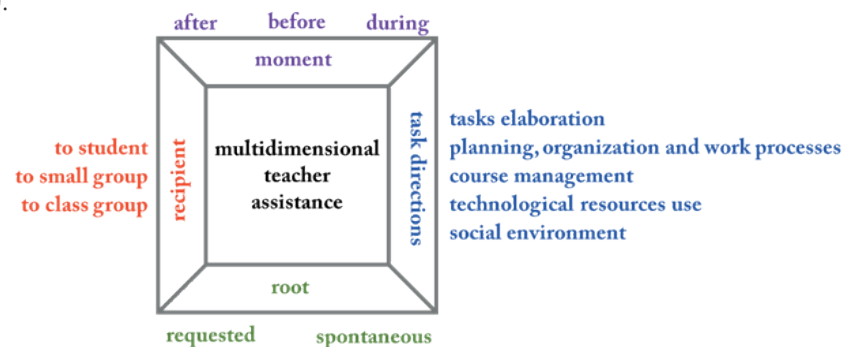


Figure 2. Dimensions of teaching assistance based on Onrubia & Engel (2012, p.170)

Macro and micro-scripting

In the same line of CSCL, on which Onrubia & Engel (2012) based their approach, the difference between micro and macro scripting, although a dichotomy, becomes relevant. The term collaboration script is a priority on the agenda of the research community on CSCL, but not all the authors call their approaches collaboration scripts; nevertheless, they use similar ideas (Kollar, Fischers, & Hesse, 2006). Although the directionality of the recipient constitutes a dimension designed by Onrubia & Engel (2012), the scripting refers to certain scaffolding and not only directionality. The term script has been used to refer to two main ideas which share the same goal but are, nonetheless, different: macroscripts and microscripts (Dillenbourg & Jermann, 2007). Any script disturbs the natural convergence of a team, increasing (or trying to increase) the intensity between team members for the achievement of a task (Dillenbourg & Hong, 2008).

Macro scripts capture and communicate pedagogical methods, that are intended to create appropriate conditions for learning-promoting interactions among participants (Villasclaras Fernández, Hernández Leo, Asensio Pérez, & Dimitriadis, 2013). Macroscripts use course-granularity components (activities, role distribution, and sequencing, among others) to guide participants by indicating task distribution, time structure of the activities, and groups in which participants are distributed to perform the assigned activities. For Dillenbourg & Hong (2008), macro scripts structure in collaborative learning means interactions such as argumentation, explanations and mutual regulation. The macro scripts are pedagogical approaches, for instance, a sequence of activities to be performed by small groups.

The micro scripts are dialogue approaches, mostly based on argumentations, which are embedded in the environment, and students are expected to adopt and progressively internalize them. Then microscript scaffolds the interaction process per se and macroscript sets up which kind of argumentation should occur. Moreover, according to Dillenbourg & Jermann (2007), micro and macroscripts are not clear-cut categories but rather define a continuum.

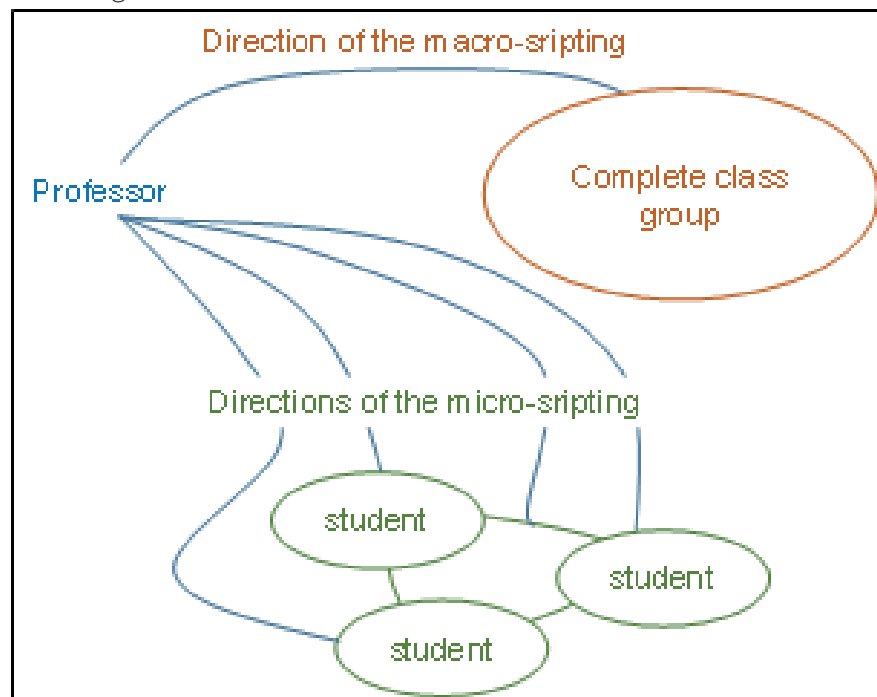


Figure 3. Directions of macro and micro-scripting based on Dillenbourg & Jermann (2007)

Twelve ways of teaching

While the three previous systems were meant to study interaction in virtual environments, the following three approaches focused on teaching as face-to-face practice. The most prevalent way of interaction at local Universities has a face-to-face teacher-centered model (Borgobello, Peralta, & Roselli, 2010; Borgobello, Sartori, & Roselli, 2016; Copertari, Sgreccia, & Fantasia, 2017). Other approaches were selected to complement the previous ones.

Aebli (2000) presented a book for professional development for teachers, introducing a system to teach how to teach based on psychological concepts. The framework refers to twelve ways of teaching grouped in three main categories (see Figure 4). Teaching by five means includes to narrate and refer; show; observe; read with students; and write. Action, operation, and concept appears when a development of an action takes place, an operation is built and a concept is formed. Four functions in the learning process involves problem solving construction; elaboration; exercise and repetition; and application. As it was said, the book is about Psychology and Didactics, and it constitutes a basic course for teachers to acquire skills to teach with several examples of each developed category.

- Teaching by five means
 - to narrate and refer
 - to show
 - to observe
 - to read with students
 - to write texts
- Action, operation and concept
 - to develop a course of action
 - to build an operation
 - to form a concept
- Four functions in the learning process
 - problem solving construction
 - elaboration
 - exercising and repetition
 - application

Figure 4. Twelve ways of teaching based on Aebli (2000).

In the group of concepts of Teaching by five means, the first group Aebli (2000) described basic teaching forms to highlight the students' acquisition of experience. Teachers recognize possibilities and problems around communication and students' experiences. In the second group, Action, operation and concept, the structure stands out. To teach demanding topics from the theoretical point of view, according to the author, it is necessary to establish complex ideative structures. The explanation of these three basic forms is based on a certain Piagetian psychological and epistemological conception of the origin of thought: conceptual thinking starts from action. Teachers in training first learn to develop (with the students) a scheme of action, then build an operation and finally, a conceptual content. The last group, Four functions in the learning process seeks to capture the learning process in a holistic sense of development starting from its four partial functions in mutual relation: construction, elaboration, consolidation and application. Because teaching is complex, it can never be said that the four functions are traced schematically in one lesson or in each teaching unit. Depending on the chosen concept, and according to the structure of the desired learning outcome, the stages will have different importance.

Rethinking the class

Rethinking the class approach argues against technocratic models of professional development for teachers based on a positivist idea of theoretical and practical relationship. Following technocratic models, practices are postponed as a final course when theory is applied (Sanjurjo, 2016). Sanjurjo (2003) understands lecture as a game in which the teacher must know the rules and plan the actions, solving them according to the context. For this, it is necessary to be able to articulate creatively the basic ways of teaching: narration, explanation, dialogue, examples, analogies, metaphors, and demonstrations, among others, proposing diverse activities and promoting meaningful understandings.

Sanjurjo (2003) recapitulated and conceptualized Aebli's theory based on systematic observations and her local experience accompanying teachers in training. The author recovered the basic forms of teaching from different traditional and recent frameworks creating activities for teachers in practical scenarios. Sanjurjo (2003) remarks oral expression as a whole, giving it an important conceptual place because it was left aside by the current didactic theoretical and methodological frameworks (see categories in Figure 5). In this line of research, authors seek to recover lecture as a possible theoretical and conceptual space, through which the teacher performs didactic activities so that the introduced concepts are understandable and rigorous at the same time.



Figure 5. Rethinking the class based on Sanjurjo (2003)

Observation record

The observation record approach was developed to study sociocognitive interaction in face-to-face classrooms. The approach was inductively built from data (Borgobello, Peralta, & Roselli, 2010) and unlike the previous five systems it was applied with adaptations to observe face-to-face classrooms (Raynaudo & Borgobello, 2018) and virtual environments (Borgobello, Sartori, & Roselli, 2016). The instrument allows recording the teaching style observed from statements made during lessons and didactic resources used. The aim of this approach was to describe interactive-pedagogical orientation of the speaker based on public verbal expressions issued in pragmatic and semantic features of communication (see Figure 6).



Figure 6. Observation record based on Borgobello et al (2010) and Borgobello et al (2016).

This paper follows a continuum between the introduction as framework, the methods designed for the study, and data analysis itself. For this reason, the Methods section takes the 47 categories from the six approaches presented above. In addition, the description of the methods is complemented with theoretical-methodological positions related to the main research line from which the data were constructed.

Methods

3.1 Sample. The unit of analysis was each one of the 117 texts written by a teacher in Moodle in a ten month blended course. The course was in social sciences, taught at a public national university in Rosario, Argentina. The communication established by the teacher configured each unit under analysis from each uploaded post. Hence, the extension in words of the texts was determined by the professor.

The case was intentionally selected on a volunteer basis collaboration. The teacher did not know about the types of analyses that would be performed until after the completion of the course. At that moment, the teacher collaborated with the understanding of data analyses. According to Turpo Gebera (2014), to achieve a correct interpretation of data, researchers need the teacher to be predisposed to think and change ways of working, besides collaboration.

3.2 Study design. An exploratory-descriptive case study was designed. The data were contrasted with the six previously described analytical systems becoming a deductive study. Reasoning started with literature and moving into traditional data analysis (Twining, Heller, Nussbaum, & Tsai, 2017); nevertheless, the main research line has an inductive tradition, initiating the analytical processes from data to contrast conclusions with literature.

3.3 Procedure. All the teacher's posts were collected for analysis. Each text was recorded as an individual written unit, differentiated by each Moodle tool or resource (e.g. block label, forum message, link, file title). The public texts, but not the private messages, were included for analyses.

Initially, each text was classified according to: block number, mention of face-to-face class, availability from main Moodle screen, text format (bold, italic, color, size and font), embedded image or video, and chosen pronoun (first singular or plural or impersonal style) in written expression, and text associated with specific conditions (block, file, folder, task, glossary, or forum title, external link, or message posted in a forum). Next, the coding process classified each text according to the six systems described above.

Two independent researchers coded 25% of posts to evaluate the reliability of the theoretical-methodological systems. The index variables below .4 were completely recoded. Data with disagreements below .4 were recoded following intersubjective accordance between both researchers for final decisions. The disagreements on 25% coded by both researchers were also recoded and analyzed to find out problematic issues for future coding process.

The most relevant data processing was correspondence analysis with selection of active and illustrative variables and classification of factorial axes. This analysis was chosen because, according to Curcio, Castellaro, & Peralta (2018) the multivariate data analysis facilitates the recognition of general trends of data, for example, by interpreting factor axes or clusters. The *Système Portable Pour L'analyse des Données* (SPAD) software was chosen to the analyses. The program uses active variables selected by the researchers to calculate phases, especially in the construction of the factors. The nominal variables under study presented by the software as significantly higher in each cluster were calculated with the Laplace-Gauss technique (test-value) illustrating the weight of the category inside the group (Moscoloni, 2005). It measured the number of standard deviations present between the proportion in the cluster and the proportion in the whole data set. In other words, a category was characteristic of a cluster when it was significantly more abundant in the group than in the data set calculated from the comparison of percentages.

Illustrative variables allowed establishing comparisons (Parra Olivares, 1996). The chosen active variables were the initial classification analyses: block number, availability from main screen, text format, embedded image or video, text associated with specific conditions (e.g. forum message, link title), mention of traditional face-to-face class, and first pronoun used in written expression. All the coded categories of the six theoretical systems were taken as illustrative variables to make comparisons.

Summarizing, multivariate data analyses were performed using SPAD for data reduction without losing complexity (Curcio, Castellaro, & Peralta, 2018; Moscoloni, 2005). The classification method –analysis of three main clusters- linked the unit of analysis (teacher's texts) with similar characteristics to the categories of the variables. The results presented below show the outstanding categories according to each set and the SPAD cluster analysis.

3.4 Instruments. A record of variables from the six theoretical-methodological systems described above was constructed. Each category of the systems was established as a variable from which individual text would be categorized. Data matrix variables are listed below. The possible variables were dichotomous, that is, usually as presence or absence of a category in the observation. Only two exceptions to this rule were present in the same system: Moment and Recipient of the assistance, which had three options.

Communities of inquiry (Garrison, Anderson, & Archer, 2000; Garrison, Anderson, & Archer, 2010): Teaching presence; Cognitive presence; and Social presence.

Teaching assistance dimensions (Onrubia & Engel, 2012): Moment (Before, during, and after); Recipient of the assistance: Student, Small group, Class group; Origin (Spontaneous or Requested); Task directions: Tasks elaboration; Planning, Organization and work processes; Course management; Use of technological resources; and Social environment.

Macro and micro-scripting (Dillenbourg & Jermann, 2007): Micro-Scripting and Macro-Scripting

Twelve ways of teaching (Aebli, 2000): Narration and reference; Showing; Observation; Reading with students; Text writing; Action planning; Operation building; Concept elaboration; Problem solving; Elaboration; Exercising and repetition; and Application.

Rethinking the class (Sanjurjo, 2003): Narration; Explanation; Dialogue and questioning; Example, analogy, and metaphor; Visual aid; and Exercises and problematic situations.

Observation record (Borgobello, Peralta, & Roselli, 2010; Borgobello, Sartori, & Roselli, 2016): Rhetorical question; Answered question; Request for quietness; Organizational matters; Reference to bibliography; Concept clarification; Conceptual relationship; Origin of concept; Metaphor, comparison, or example; Suggestions of academic procedures; Motivational expression; Non-conceptual answer to students; and Foreign statement.

3.5 Data analysis. Three types of data analyses were executed. The first one measured inter-rater agreement, the second type established common and uncommon codes, and the last developed analysis was a multiple correspondence analysis to group the data according to categories under study.

Cohen's Kappa coefficient was used to measure inter-rater agreement for qualitative categorical items. An average of each system variables was calculated to illustrate the most reliable and simple to code systems –at least for this research team.

The common and uncommon codes were processed with descriptive statistical analyses (frequency analysis and percentage) after recodification processes took place.

Finally, a multivariate analysis of the data was carried out, for which a multiple correspondence analysis was ran with selection of active and illustrative variables and classification of factorial axes.

Teaching assistance dimensions coding system (Onrubia & Engel, 2012) produced two recodification processes. The first one was Use of technological resources. One of the researchers only used it when the technological resource was embedded or linked in the text, while the other researcher coded it when the technological resource was only mentioned. At the second coding moment both ways of coding were used, being dismissed when technology was non-related with the task. The second one was Course management. It was agreed that this code would be used when the text referred to a unit larger than a class or a task (for example, the course program or objectives) appeared.

Most disagreements on Twelve ways of teaching (Aebli, 2000) occurred when one of the researchers used codes when ideas were not explicit enough in the texts, using each item fewer times than the other researcher. The recoding process figured the speaker intentions out on which instruction was based. Following this coding system, the Text writing code was used when the teacher was checking students' written texts because it was understood that teaching how to write properly was taking place. The Concept elaboration code was used when the teacher condensed an idea, or highlighted a concept to be used later. Disagreement on the Elaboration code occurred when one of the researchers understood this code only as re-elaboration following a dialogue. Finally, it was also coded when direct instructions were given. The Application variable had the lowest agreement measure. Difficulties appeared about analysing the teacher giving students application direct instructions or only when assessing productions. The disagreement was solved by adding the request for a tangible object. The difference with the Elaboration code was only the existence of feedback without the request for the tangible object.

Rethinking the class (Sanjurjo, 2003) had only one variable recoded: Dialogue and questioning. Contrasting both codification processes, the code was used for spontaneous dialogue and for invitation to dialogue.

Of the four systems previously used to analyze virtual interactions, only one required recoding variables. Course management and Use of technological resources from Teaching assistance dimensions (Onrubia & Engel, 2012) were recoded because they required interpretive adjustments according to the data.

On intersubjective agreements, Cohen's Kappa coefficient showed Macro and micro-scripting system (Dillenbourg & Jermann, 2007) as the highest rated and Twelve ways of teaching coding system (Aebli, 2000) as the lowest. Nevertheless, the system presented by Dillenbourg & Jermann (2007) had only two codes, it was the clearest system to describe a short part of virtual interaction, even more, one of the variables had a complete agreement.

4.2 Common and uncommon frequently used codes

After recoding took place, the most remarkable categories were Use of technological resources, Teaching presence, Narration and reference, and Showing because they had the highest frequency (see Table 1). The lowest categories could also be emphasized: Rhetorical question, Answered question, Origin of concept, Non-conceptual answer to students, After the task, Reading with students, and Request for quietness. It should be noted that five over seven of less frequently used codes belong to the widest systems: Twelve ways of teaching and Observation record.

Results

4.1 Agreements, codifications, and recodifications

The first part of the results reports the intersubjective agreements between researchers, the most problematic codification processes, and how disagreements were solved.

According to the initial results, all variables below .4 on Cohen's Kappa coefficient were recoded (Table 1). Recodification perspectives and dialogues are presented for a better understanding of data.

Macro and micro-scripting approach (Dillenbourg & Jermann, 2007), a two variables system, had the highest average on Cohen's Kappa coefficient and Twelve ways of teaching (Aebli, 2000) coding system had the lowest one.

Table 1. Initial inter-rater agreement and final codification

| Coding System | Variables and categories | Kappa | System's Kappa average | n | % |
|--|---|-------|---------------------------|----|-------|
| | | | | | |
| (a)- Communities of inquiry | Teaching presence | 0.868 | 0.697 | 83 | 70.9% |
| | Cognitive presence | 0.71 | | 69 | 59.0% |
| | Social presence | 0.514 | | 54 | 46.2% |
| | Before the task | | | 60 | 51.3% |
| | During the task | 0.483 | | 55 | 47.0% |
| | After the task | | | 2 | 1.7% |
| | To Student | 1 | | 11 | 9.4% |
| (b)- Teaching assistance dimensions | To Small group | 0.652 | 0.686 | 54 | 46.2% |
| | To Class group | 1 | | 67 | 57.3% |
| | spontaneous | 0.652 | | 64 | 54.7% |
| | Requested | | | 53 | 45.3% |
| | tasks elaboration | 0.86 | | 73 | 62.4% |
| | Planning, organization and work processes | 0.86 | | 70 | 59.8% |
| | Course management ¹ | 0.331 | | 45 | 38.5% |
| (c)- Macro and micro-scripting | Use of technological resources ¹ | 0.097 | 0.868 | 93 | 79.5% |
| | Social environment | 0.924 | | 56 | 47.9% |
| | Micro-Scripting | 1 | | 52 | 44.4% |
| | Macro-Scripting | 0.736 | | 36 | 30.8% |
| | Narration and reference | 0.737 | | 82 | 70.1% |
| | Showing | 0.523 | | 82 | 70.1% |
| | Observation | 0.475 | | 33 | 28.2% |
| (d)- Twelve ways of teaching | Reading with students | 1 | 0.551 | 0 | 0.0% |
| | Text writing ¹ | 0.224 | | 28 | 23.9% |
| | Action planning | 0.621 | | 78 | 66.7% |
| | Operation building | 0.518 | | 53 | 45.3% |
| | Concept elaboration ¹ | 0.367 | | 17 | 14.5% |
| | Problem solving | 1 | | 25 | 21.4% |
| | Elaboration ¹ | 0.289 | | 27 | 23.1% |
| Exercising and repetition ¹ | 0.71 | 35 | 29.9% | | |
| Application | 0.152 | 40 | 34.2% | | |
| Narration | 0.931 | 73 | 62.4% | | |

| | | | | | |
|---------------------------|---------------------------------------|-------|-------|-------|-------|
| (e)- Rethinking the class | Explanation | 0.408 | 66 | 56.4% | |
| | Dialogue and questioning ¹ | 0.367 | 72 | 61.5% | |
| | Example, analogy, and metaphor | 0.446 | 0.615 | 49 | 41.9% |
| | Visual aid | 0.672 | 58 | 49.6% | |
| | Exercises and problematic situations | 0.864 | 74 | 63.2% | |
| | Rhetorical question | 0.652 | 5 | 4.3% | |
| | Answered question | 1 | 4 | 3.4% | |
| | Request for quietness | 1 | 0 | 0.0% | |
| | Organizational matters | 0.529 | 78 | 66.7% | |
| | Reference to bibliography | 0.868 | 36 | 30.8% | |
| (f)- Observation record | Concept clarification | 0.518 | 21 | 17.9% | |
| | Conceptual relationship | 0.475 | 11 | 9.4% | |
| | Origin of concept | 0.652 | 0.770 | 3 | 2.6% |
| | Metaphor, comparison, or example | 0.652 | 43 | 36.8% | |
| | Suggestions of academic procedures | 0.859 | 55 | 47.0% | |
| | Motivational expression | 0.817 | 36 | 30.8% | |
| | Non-conceptual answer to students | 1 | 3 | 2.6% | |
| | Foreign statement | 1 | 8 | 6.8% | |

Note. 1= Completely recoded variable

An unused code was Reading with students. This could be explained due to the analysis of interaction mostly asynchronous, classroom activity in parallel (traditional classroom), perhaps reading with students could occur face-to-face as well as the use of resources for Request for quietness, another unused code.

Continuing with common and uncommon frequently used codes and considering interactions took place in a virtual environment, the presence of technology elements was expected, but not largely observed. A characteristic that stands out in this course –considered unusual in a teacher-centered model context–, was the wide presence of scaffolding and guidance. Narration usually appeared showing

different instructional ways to solve problems, consistent with what has been presented before. The direct questions seemed to have infrequent presence, concepts were barely historicized, and the post-task closure was unusual.

4.3 Clusters analysis

The results of multivariate data analysis facilitate, as it was said, the recognition of general trends of data.

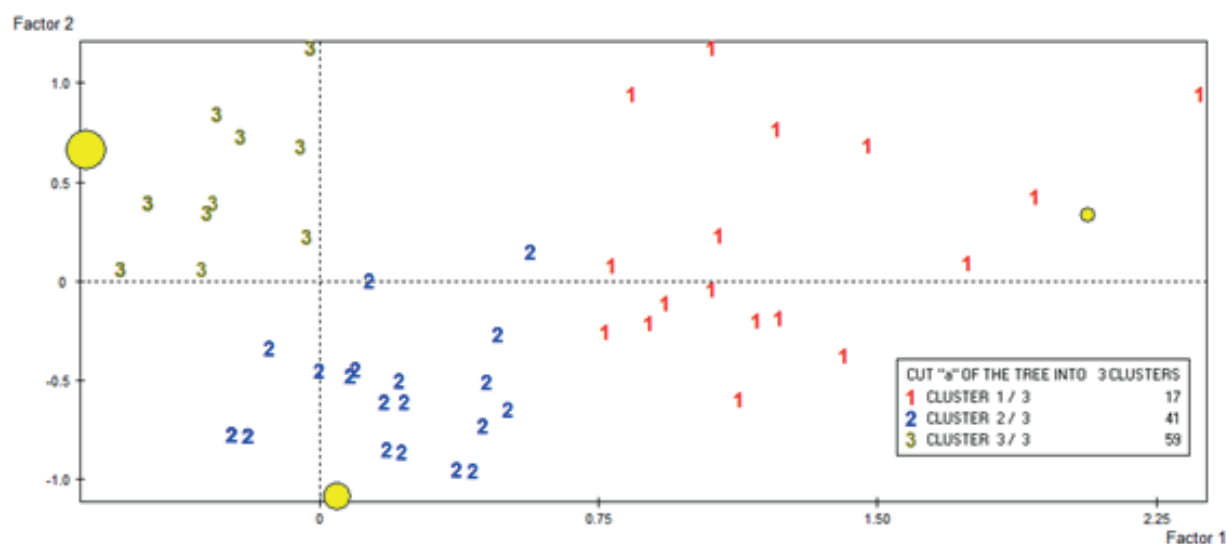


Figure 7. Clusters construction

All the variable systems were explored together with multivariable analysis. Figure 7 shows the clusters positioned on the factorial plane, which allows visualizing the setting in space and concentration of units under analysis. The analysis delivered three Clusters showing paradigmatic groups of texts, being the third the larger one.

Cluster 1 gathered 17 texts representing 15% of the sample. Iconic posts targeted to the whole group, like macro-scripting instructions written spontaneously (mainly as block title and initiating group tasks), based on the course management were the characteristic of this group (Table 2). This texts showed the use of Moodle as general instructional platform.

Cluster analyses showed texts used by the teacher as general instructions connected with different variables from theoretical-methodological coding systems used. The first cluster was associated to macro-scripting from [Dillenbourg & Jermann \(2007\)](#) approach, and course management, spontaneous posts directed to class-group, and written before the task were categories from Teaching assistance dimensions approach by [Onrubia & Enge \(2012\)](#).

Table 2. Cluster 1

| Characteristic categories | % of category in group | % of category in set | Test-value* |
|-----------------------------|------------------------|----------------------|-------------|
| Block title | 52.94 | 7.69 | 5.82 |
| Available from main screen | 88.24 | 29.91 | 5.21 |
| Macro-scripting | 82.35 | 30.77 | 4.54 |
| Image embedded | 35.29 | 5.13 | 4.47 |
| Course management | 88.24 | 38.46 | 4.32 |
| Spontaneous | 100.00 | 54.70 | 4.23 |
| Block 8 | 29.41 | 4.27 | 3.96 |
| To class group | 94.12 | 57.27 | 3.29 |
| Before the task | 88.24 | 51.28 | 3.16 |
| Traditional class mentioned | 52.94 | 19.66 | 3.13 |
| Block 4 | 17.65 | 2.56 | 2.79 |
| Scheduled task title | 23.53 | 5.13 | 2.65 |

Note. Count:17; Percentage: 14.53. *z = p.≥1.96 (.05)

Cluster 2 gathered 41 texts representing 35% of the sample (see Table 3). The most distinctive features of the group were impersonal, non-descriptive, without scripting, related to files or external links texts (use of technological resources and reference to bibliography), written in plain text with impersonal language.

Table 3. Cluster 2

| Characteristic categories | % of category in group | % of category in set | Test-value* |
|--------------------------------|------------------------|----------------------|-------------|
| Before the task | 100.00 | 51.28 | 8.36 |
| Spontaneous | 100.00 | 54.70 | 7.84 |
| To class group | 100.00 | 57.27 | 7.46 |
| File | 56.10 | 22.22 | 6.25 |
| Block 2 | 39.02 | 14.53 | 5.27 |
| Impersonal | 82.93 | 52.99 | 4.71 |
| Use of technological resources | 100.00 | 79.49 | 4.35 |
| Block 6 | 29.27 | 11.11 | 4.27 |
| Forum title | 21.95 | 7.69 | 3.93 |
| Reference to bibliography | 53.66 | 30.77 | 3.69 |
| Available from main screen | 48.78 | 29.91 | 3.03 |
| Plain text | 100.00 | 88.89 | 2.81 |

Note. Count:41; Percentage: 35.04. *z = p.≥1.96 (.05)

In addition, the cluster was configured by Teaching assistance dimensions ([Onrubia & Engel, 2012](#)) categories as before the task, spontaneous and directed to class group texts with Use of technological resources. The reference to bibliography was mainly related to Observation record approach ([Borgobello et al, 2010](#)). This cluster illustrates the platform use as repository.

Cluster 3 grouped 59 texts representing 50% of the sample (Table 4). This cluster was the largest one. The outstanding group characteristic was the texts showing interactions during tasks: answers to students based on dialogue, micro-scripting, organizational features with main teaching and social presence, and written in first person were the most noticeable categories. This group of texts showed the use of Moodle as a tutorial interactive virtual environment.

Table 4. Cluster 3

| Characteristic categories | % of category in group | % of category in set | Test-value* |
|---|------------------------|----------------------|-------------|
| Forum message | 98.31 | 49.57 | 11.93 |
| During the task | 93.22 | 47.01 | 11.14 |
| Requested | 89.83 | 45.30 | 10.69 |
| Micro-scripting | 88.14 | 44.44 | 10.48 |
| Dialogue and questioning | 100.00 | 61.54 | 9.32 |
| Block 7 | 88.14 | 51.28 | 8.29 |
| To small group | 81.36 | 46.15 | 7.91 |
| Exercises and problematic situations | 96.61 | 63.25 | 7.87 |
| Teaching presence | 100.00 | 70.94 | 7.48 |
| Task elaboration | 89.83 | 62.39 | 6.21 |
| Observation | 52.54 | 28.21 | 6.06 |
| Social presence | 72.88 | 46.15 | 5.81 |
| Narration | 88.14 | 62.39 | 5.78 |
| Organizational matters | 91.53 | 66.67 | 5.77 |
| Planning, organization and work processes | 84.75 | 59.83 | 5.49 |
| Social environment | 71.19 | 47.86 | 5.00 |
| Metaphor, comparison, or example | 57.63 | 36.75 | 4.63 |
| Example, analogy, and metaphor | 62.71 | 41.88 | 4.49 |
| Text writing | 38.98 | 23.93 | 3.73 |
| Application | 50.85 | 34.19 | 3.69 |
| To Student | 18.64 | 9.40 | 3.41 |
| First pronoun used | 62.71 | 47.01 | 3.27 |
| Suggestions of academic procedures | 62.71 | 47.01 | 3.27 |
| Concept elaboration | 25.42 | 14.53 | 3.24 |
| Problem solving | 33.90 | 21.37 | 3.18 |
| Elaboration | 35.59 | 23.08 | 3.08 |
| Motivational expression | 44.07 | 30.77 | 2.97 |
| Cognitive presence | 72.88 | 58.97 | 2.91 |
| Action planning | 79.66 | 66.67 | 2.83 |
| Conceptual relationship | 16.95 | 9.40 | 2.61 |
| Exercising and repetition | 40.68 | 29.91 | 2.38 |

The third group presented the tutorial interactivity in virtual environments and it had diverse categories. From the Communities of inquiry approach (Garrison, Anderson, & Archer, 2000; Garrison, Anderson, & Archer, 2010), the three categories were represented differently: teaching, social, and cognitive presences. The texts written were micro-scripted according to Dillenbourg & Jermann (2007). From the Teaching assistance dimensions approach (Onrubia & Engel, 2012) the interactions were described as during the task, requested by the students, directed to small groups or to individual students, constructed during task elaboration and with social environment. Eight from the Twelve ways of teaching approach (Aebli, 2000) were found in the constitution of this cluster illustrating interactions: observation; text writing; application; concept elaboration; problem solving; elaboration; action planning; and exercising and repetition. Regarding the Rethinking the class approach (Sanjurjo, 2003), the dialogue and questioning; exercises and problematic situations; example, analogy, and metaphor; narration; and planning, organization and work processes codes were found. According to the Observation record approach (Borgobello, Peralta, & Roselli, 2010) the written messages were about organizational matters; metaphors, comparisons, or examples given; academic procedure suggestions; motivational expressions, and conceptual relationships.

As it was illustrated above, interaction among variable categories resulted on typical groups of texts. The categories from the Teaching assistance dimensions approach designed by Onrubia & Engel (2012) had a major relevance on the cluster main categories. The block numbers, designed and used in chronological order by the teacher did not show any important relationship within the cluster construction.

Discussion

A general benefit of the methodological decisions made was the choice of each text written spontaneously by the teacher as a unit in itself, beyond the amount of words. This choice allowed preserving some of the real complexity of teacher's discourse, keeping independence of each text in data set for further analyses. Additionally, an analysis of written texts could be considered an advantage compared to coding transcribed texts of oral discourse, being each unit considered direct data (Borgobello, Sartori, & Roselli, 2016).

Two of the systems used, the Twelve ways of teaching (Aebli, 2000) and the Rethinking the class (Sanjurjo, 2003) were designed for teacher training. These two systems showed, perhaps not by chance, the lowest rates of intersubjective agreement measures. It should also be remarked that the system developed by Sanjurjo (2003) was presented by the author as a conceptual revision of ideas displayed by Aebli (2000) based on her own local practice in teacher training. However, Sanjurjo (2003) seemed to give greater clarity for the categorization of variables on agreement levels. Because of this, it should be chosen for further research.

Another difficulty of the study was the use of three systems originally configured to think face-to-face interactions in coding virtual classes: Twelve ways of teaching (Aebli 2000); Rethinking the class (Sanjurjo 2003); and Observation record (Borgobello, Peralta, & Roselli, 2010; Borgobello, Sartori, & Roselli, 2016). These systems represent the diversity in oral presentations, having a large number of codes, especially those designed by Aebli (2000) and Borgobello, Peralta, & Roselli (2010; 2016).

The virtual interaction in blended learning scenario, according to data, would have loosened part of the pragmatic and semantic heterogeneity usual in oral language interaction as it was remarked by Borgobello, Sartori, & Roselli (2016). The reason of this could be the result of face-to-face meetings during the same period of time that could have been wider conceptual lectures, with openings and closings, beyond others. This would also explain the scarce presence of some categories like Request for quietness in data set.

An additional difficulty found in data analyses was the apparent uncomplicatedness, simplicity, and transparency of the codes initially used in each system. Emphasis is placed on the term "apparent" because, as it could be seen on the recodification processes needed, intersubjective agreements evidenced difficulties on practical applications.

Although, as it was clarified, only one case with a large number of categorical variables was analyzed. Multivariate methods of data analysis used could be considered appropriate to the chosen methodological approach. The exploratory factorial analysis moderates the possible distortions caused by the different measures taken with their relative positions depending on the data. This analysis, according to Curcio, Castellaro, & Soledad (2018) and Moscoloni (2005), differs from traditional Statistics when classification takes real values of each individual in each of the original variables.

Equally important for the research team is thinking cases through theory (and vice versa) allowing for searching reliable analytical tools. Undoubtedly, future studies should amplify theoretical-methodological approaches contrasting this case with new data to get better understanding of sociocognitive interaction among students and teachers in blended learning.

Conclusion

In the first place, it should be noted that six coding systems elaborated in highly dissimilar theoretical-methodological contexts were used. This situation involves difficulties of articulation, agreements, and with empirical data, but it was indeed the challenge of this study.

Summarizing, the main purpose of this paper was to describe the characteristics of the texts written by the teacher in a virtual environment in a blended learning course. Along with the main purpose, the research team had a methodological aim: to analyze theoretical systems contrasting them with data. According to research experience, the choice of theoretical-methodological tools from literature needs interaction with approaches and data. In other words, the selection of each system was determined by the kind of data under analysis and debates around concepts, approaches, and data itself.

Recapitulating, three data analyses were performed: measurement of inter-rater agreement to analyze reliability of the systems chosen; common and uncommon used codes to establish the most salient features of the data set; and multiple correspondence analysis to construct profiles of text grouped by similar characteristics.

Following the Cohen's Kappa coefficient, the Macro and micro-scripting (Dillenbourg & Jermann, 2007) and the Observation record (Borgobello, Peralta, & Roselli, 2010) sets of variables were the two most reliable systems for the data under analysis. The systems with less reliability were the Twelve ways of teaching (Aebli, 2000) and the Rethinking the class (Sanjurjo, 2003) approaches. Despite results, the Teaching assistance dimensions (Onrubia & Engel, 2012) and the Communities of inquiry (Garrison, Anderson, & Archer, 2000; Garrison, Anderson, & Archer, 2010) approaches had categories for data

analysis not found in the other systems, giving sense to data. Future research projects should consider these and other analyses to choose theoretical-methodological approaches.

The second data analysis performed presented the most frequent categories from all the six systems, illustrating the characteristic features of the data set. The most frequent categories found were Use of technological resources, Teaching presence, Narration and reference, and Showing codes.

It could be observed that written texts reveal how intentions take place and show pedagogical models underlying the didactic proposals. The third analysis performed, the characteristic clusters based on the variables provided by the six coding systems displayed qualitative differences on contextualized elaboration of texts in virtual environments with blended design. Despite the difference in the percentage of data, each group represents paradigmatic texts of a virtual environment use such as Moodle. The first group represents the texts used by teachers as general instructions delivered for the complete class-group. The second cluster illustrates the use of the platform as repository with links, files, and literature. The last one characterizes the tutorial functions, illustrating interactivity in virtual environments.

According to the research team, beyond findings, one of the most important contributions of this paper was the methodological construction that allowed rethinking theoretical approaches based on a case analysis. Nevertheless, it was only one case under analysis, data analyses could enable theoretical considerations on a larger scale.

Finally, this kind of results and analyses have a long-term purpose, they could be used to collaborate in teacher training in the use of Moodle supporting traditional university education, and mainly in contexts similar to ours dealing with some resistance to the use of ICT blended face-to-face interaction.

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