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Using graphical tools in a phased activity for enhancing dialogical skills: An example with Digalo

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Abstract ICT tools have been developed to facilitate web-based learning through and learning about argumentation. In this paper we will present an example of a learning activity mediated by Digalo-software for knowledge sharing through visually supported discussion-developed in a university setting. Our aim is to examine, in particular, socio-cognitive construction of knowledge and argumentation by students debating a controversial question in history. We propose a descriptive approach of understanding and meaning-making processes based on two levels of analysis: (1) a topic meaning-making process oriented level and (2) an argumentation oriented level. We focus our studies on how the participants-small groups of students-develop understanding of the topic, their arguments and their interactions through the use of different functionalities of this software. Our results show that interactive and argumentative processes are themselves objects of learning and develop through collective activity. Development of the understanding of the topic through argumentation is discussed and linked to the design of the activity and the affordances of the Digalo software.

Keywords Argumentation · Dialogue · Learning · Argumentative maps · ICT tool

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Introduction

Sepulveda: *Indian people do not possess the art and ways of humans. You sacrifice human beings.*

The Indians: *And your massacres??? We have an eschatological justification for our sacrifices. But you, you torture us, slaughter our women and children in God's name of love, goodness and pardon. Is this not a paradox?*

Las Casas: *We might have committed such sacrifices as well, let us remember Isaac!* (...)

The Indians: *We ask you nothing: before your arrival, everything went well for us, we do not need either your help or your religion...*

This "dialogue" is an extract from a learning activity where students were asked to role-play the characters of the Valladolid Controversy: Sepulveda, Las Casas and the Aztec Indians, and to discuss the question that was raised in mid 16th Century: "Do Aztec Indians have a soul? Are they human beings?" As an historical event, this controversy took place in the Spanish city of Valladolid between 1550 and 1551, when the Spanish King Charles-Quint, by the mediation of the Papal Legate, asked theologians and intellectuals Bartolomé de Las Casas and Ginès de Sepulveda to discuss whether New World Indians could be considered human beings. This discussion had an important issue in economical and political terms, as it involved whether the Spanish Conquistadors should keep Indians as slaves for extracting gold and provide, thereby, important resources to Spain or not. The learning activity that we proposed to our students in this role-play version was mediated by argumentative software called Digalo; it aimed at enhancing argumentative skills and historical knowledge about the Valladolid Controversy and its context.

This paper is grounded on two main theoretical and pedagogical concerns in the domain of learning. On the one hand, scholars emphasize not only interactions but also argumentative interactions as powerful tools for developing learning and thinking processes (Driver et al. 2000; Leitão 2000; Schwarz et al. 2000). On the other hand, some researchers study the potential of information and communication technology (ICT) representational supports that can sustain argumentation activity (Andriessen et al. 2003; Schwarz and Glassner 2003a; Veerman and Treasure-Jones 1999). Taking these two directions as starting points, we first acted as "pedagogical designers" and elaborated a learning and argumentative activity mediated by a specific argument mapping environment, Digalo, and proposed it to students. As researchers, our aim is to better understand meaning-making processes elaborated by the groups of participants: What kind of understanding of this historical topic did they build? How has argumentation developed through this particular interactive and CSCL-tool mediated activity? What are the tool affordances that seem salient towards the topic building and argumentative processes? These questions more generally relate to the possible effects of argumentative practices on learning in educative contexts and to their conditions of efficiency.

In this paper, we intend to present the main outcomes of an "exploring and understanding" analysis (Koschmann et al. 2003). We will therefore follow, step-by-step, how students, in small working groups, use this tool, and what purposes it serves in terms of construction of knowledge and argumentation. This article starts with some theoretical points about the social dimension of argumentation and its links to learning, as well as the role of particular CSCL environments in such activity. In a second part, both the learning activity and our methodological approach are presented, and the analysis and its results are developed and discussed.

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What is argumentation?

In its elementary form, the basic task of argumentation is to develop an argument that gives "evidence" for the validity of an answer to a disputed topic, the question at stake. It consequently involves the idea of "helping recognize" the reasonableness of a position (Rigotti and Greco 2004). It grows in communicative and interactive processes, and generally takes the form of a dialogue. Argumentation has a long tradition in philosophy, logic, and the epistemology of sciences. Many definitions are available that point either to its logical or its social dimensions, to its agonistic orientation-where the aim is to convince- or to its exploratory goals-aiming at opening, testing, and developing multiple points of views or resolving a problem.

Some authors study argumentation by focusing on its dialogical dimension (Baker 2004; Leitão 2001). Saying that argumentation is a dialogical process is interesting, as it focuses on aspects that are, in our view, interdependent. First, focusing on the pragmatic conditions of argumentation, we can say that argumentation occurs always (or almost) in a certain type of dialogue: to argue involves different perspectives on a same object, different "voices" in contrast, a proponent and an audience or an opponent. Let us imagine a pupil writing an argumentative text: the situation can be seen as a dialogue; not only does she defend a point of view in introducing different perspectives but she is also aware that the text has her teacher as audience. But, second, argumentation can also be considered as dialogic in a more Bakhtinian meaning, as it takes form and sense in the words of the other, even if the latter is oneself (Bakhtin/Volosinov 1929/1973, 1930/1983). This dialogical dimension can also be seen as constitutive of argumentation itself, as it involves two main processes: justification and negotiation (Leitão 2001). For the study of teaching-learning processes, it is hence important to consider argumentation within different forms of social interactions, with special attention paid to the role of dialogue in knowledge construction and thinking.

Argumentation in educational contexts

Argumentation is often rediscovered and described as a cognitive, interactive and dialogical activity (van Eemeren 2003; Leitão 2000) as it is grounded in experiences or knowledge and is to some extend linked with logical thinking. Argumentation is seen as a means to open new points of view to oneself and to others and to increase one's knowledge, as it implies different socio-cognitive operations, namely justification and negotiation. In everyday settings however, when people take part in an argument they frequently seem to be less interested in "finding the truth" than in achieving social effects such as gaining respect or influence or marginalizing an opponent (Miller 1986; Schwarz and Glassner 2003b).

Trying to promote argumentative activities in the classroom raises interesting questions. For example, how will children develop argumentation skills? From a developmental point of view, argumentation, if strictly defined as the only justification of one's position, appears at a very early age, around three or four (see for example, Dunn and Munn 1987; Stein and Albro 2001). But defined as a discourse that takes into account and refutes the opposing arguments of the defended thesis, argumentation appears later, around 17 or 18 years old, in written texts (Golder and Coirier 1994).

Another interesting question is about which kind of discursive practices need to be enhanced in order to foster argumentation. Collaborative dialogue is not sufficient. The role of some lower level features, such as roles, strategies and moves, has to be understood in

order to identify the specific types of dialogues that support this kind of learning. Mercer (1995) and Mercer and Wegerif (1999) have shown, for instance, how the exploratory talk approach, based on ground rules for dialogical reasoning, can bring pupils to improve their generic reasoning skills. Other studies have tackled the necessity of structuring and supporting learners' dialogue in order to bring up clear and significant educational benefits. They show that collaborative argumentation is often essential to support a deeper dialogue that will reveal conceptual development and improve the reasoning of learners (Mac Alister et al. 2003). In this perspective, Wood (1996) for instance, constructs argumentative activities with teachers in mathematics classrooms by defining social rules for communication and, later, observes socio-cognitive conflicts likely to facilitate the acquisition of mathematical notions (see also Osborne et al. 2001). Four socio-cognitive mechanisms are part of the argumentation activity and can explain the learning gain: knowledge is becoming explicit; conceptual changes occur; new knowledge is co-elaborated through interactions, and articulation between links increases (Baker 2004). These examples of empirical and theoretical studies, among many others, join up with Vygostsky's (1978) approach to learning, for which the appropriation of external linguistic processes that occur in social settings may allow the development of higher level mental processes.

If many scholars agree with the idea of the potential of argumentation in learning, they also point out the fact that argumentation activities have to be carefully implemented: "individual reasoning can benefit from arguing to learn, but argumentation must be scaffolded by the environment to support a gradual appropriation of collaborative argumentation" (Andriessen 2006, p. 899). The questions of how to frame and set up argumentative activities in schools, in order to become "effective" in terms of learning, have lead some researchers to work with ICT tools.

The role of ICT tools in argumentative learning

Some ICT tools have been developed to support argumentative activities in classrooms. Digalo has been conceived to aim and facilitate learning through and learning about argumentation. Like other tools meant to support argumentative learning (Hron and Friedrich 2003), Digalo provides graphical and visual descriptions of arguments that can serve as external references for collective learning or problem solving.

Other similar tools have been analyzed and results from theses studies show that visual representations and structured dialogues may facilitate learning (Baker and Lund 1997; Hirsch et al. 2004; Schwarz and Glassner 2003a; Suthers 2003). For example, Baker and Lund (1997), and later Soller et al. (1999), implemented an interface related to the speech act theory that constrains the user to choose explicitly pre-defined types of "communicative acts," such as questions and justifications. These types were expressed by sentence openers such as "I propose to...," "To justify...," "I agree because..." and participants had to select and complete them. Results point out that structuring dialogue promotes more task-focused and reflective interactions and is an adequate pedagogical tool for virtual learning groups (Hron et al. 2000).

The Digalo software is designed to provide visualization of the ongoing discussion and sustain argumentation. The "argumentative maps" are a visual representation on a common screen and allow for written arguments inserted in shapes of different kinds with arrows to connect them. These argumentative maps trace the discourse and keep it visible under the participants' eyes. This allows for (1) elaboration of arguments, because unlike an oral debate, participants have time to write down their arguments and reflect on them (Veerman

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and Treasure-Jones 1999); (2) production of explicit speech acts (Baker and Lund 1997); (3) visibility of the arguments on the map, which helps to concentrate on the evolution of the debate and prevents participants from losing the thread of the discussion (Glassner and Schwarz 2004; Suthers 2003); and (4) the possibility to make relations and links between the visible propositions, helping to maintain coherence during the discussion (Munneke et al. 2003). From the analysis of different types of representations, Suthers (2003) develops three specific hypotheses concerning their affordances: representational notations influence learners' ontologies (a representational notation limits what can be represented); salient knowledge units receive more elaboration (the participants will be more likely to attend to, and hence elaborate on, the knowledge units that are perceptually salient in their shared representational workspace); salience of missing knowledge units guides information research (unfilled fields in the organizing structures, if perceptually salient, can show missing knowledge units to be as salient as those that are present). Graphical tools can thus facilitate negotiation and justification practices and the elaboration of a shared understanding through the integration of the points of view of others in the learners' own thinking.

Previous studies have also pointed out the necessity of considering the local context in which successful argumentation takes place as "we don't argue with anyone about anything at anytime" (Ravenscroft 2003). Relying on these assumptions, the interactive software Digalo has been created by both computer scientists and educational and psychological scientists. Let us describe its main functionalities.

Digalo functionalities

Digalo has been developed and tested in the context of the 5th Program Frame of the European Commission (DUNES[1] project—Dialogical argUmentative Negotiation Educational Software). It is an interactive environment that allows visualization of the ongoing discussion through an argumentative map. Thanks to its flexibility, it can be adapted to various learning and work-place contexts.

The Digalo tool is a graphical editor that allows the users to create and handle argumentative maps. Fed by the users' written contributions, these maps increase through discussion and provide a picture of its evolution-who said what, when, to whom, etc. -while notifying the argumentative form and structure of the discussion. On the shared screen each participant or group is identified by means of a symbol. Each can select one of the predetermined shapes that designate the nature of the proposition: argument, idea, comment, information, question... Then, one can write down a main idea (in the "title" window) and develop it (in the "comment" window). With the help of a selected arrow, this shape can be linked to others and signal the opposition, agreement or neutral orientation of the relationship (Fig. 1).

Let us take the example of three functionalities. In the forthcoming analysis, these three functionalities will be studied as they appear to be significant affordances for argumentation and knowledge construction: (1) The "title" window: participants write down a title, and

[1] DUNES (Dialogical argUmentative Negotiation Educational Software) is a European project funded by the 5th Program Frame of the European Commission (IST-2001-34153). It involved nine participants, academic partners and software developers from France, Germany, Greece, Israel, The Netherlands, Sweden, Switzerland and the UK (http://www.dunes.gr/).

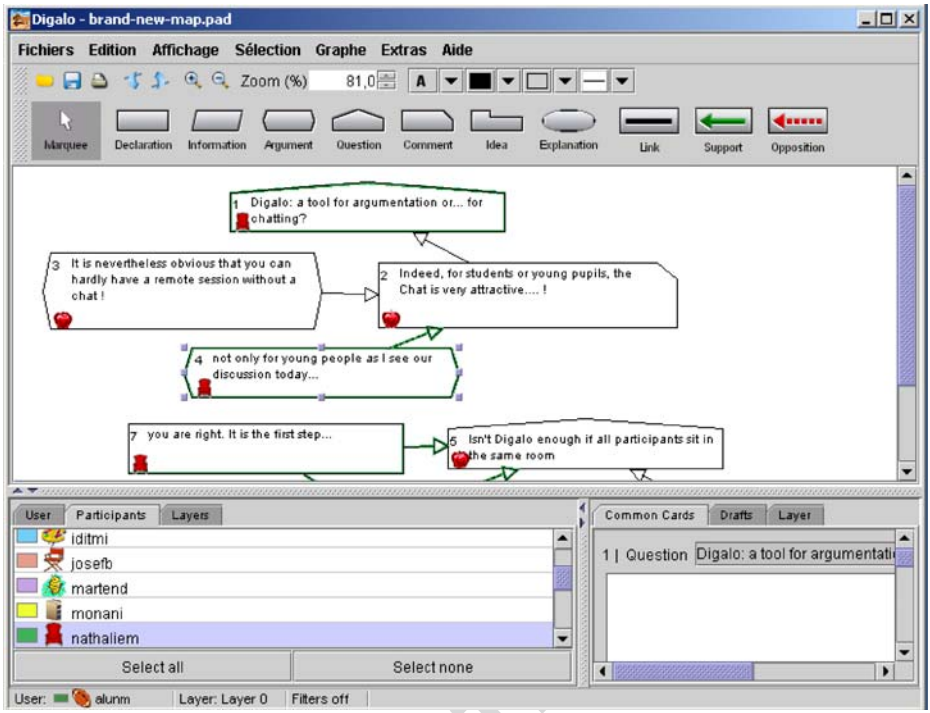

Fig. 1 Digalo software and its functionalities

thus formulate, using few words, their main ideas or "claims", making them explicit for others and themselves (at least, this is what was intended by the Digalo designers); (2) The "comment" window: participants can justify their propositions and points of view; they are thus incited to ground, develop and justify them; (3) The arrows: participants are invited to place links between the different points of view. This leads them to think about the relationship between the various utterances and to take into account the perspectives of their partners.

Participants and learning situation

We designed a learning activity in history, mediated by Digalo, and following a socio-constructivist approach to learning that considers the learner as an active participant in her own learning through interaction with others.

We took the Valladolid Controversy as the frame for the learning activity. The Controversy took place in the Spanish city of Valladolid between 1550 and 1551, when the Spanish King Charles-Quint, by the mediation of the Papal Legate, the Cardinal Roncieri, asked the theologians and intellectuals Bartolomé de Las Casas—a Dominican priest officiating in the New World—and Ginès de Sepulveda—an historian and translator of Aristotle—to discuss the question of the New World Indians' soul. Charles-Quint, coming from Europe where the Reform was at its greatest expansion, was not willing to defer to Rome's authority on such debate... Nevertheless, the verdict of the Papal Legate recognized that Indian people did indeed have a soul, as Las Casas was battling for. Consequently to

the Papal Legate's decision, slavery of Indian people was forbidden. Therefore, they stood for their rights to freedom and to own propriety. Trying to apply the Papal Legate's decision brought on strong oppositions and was largely disrespected by colonizers, but this statement nevertheless became the official position of the King of Spain and the Catholic Church.

With 11 advanced Psychology and Education students (third and fourth year of study) in the frame of practical works, we used as a base the learning activity created by historians and teachers of history (Bourdin et al. 2001; Carrière 1992) for secondary school pupils. At the time of the experiment, the students were between 23 and 40 years old; it took place at the University of Neuchâtel in 2003. The learning activity takes the form of a role-play between historical characters who were actors of the Controversy: Las Casas, Sepulveda and the Indians. The students are split into three groups, each of them taking the role of one of the three characters (Fig. 2).

We consider that involving learners in a role-play is an interesting activity here, as it raises the important issue in history about the relationship between events and people in other periods of time. Therefore, it provides an opportunity for the participants to experiment a double process of "decentration": as Europeans towards Aztec culture and as modern citizens towards the strange questions asked by the Papal Legate. It also seems a good opportunity to become aware of the importance of debating in history, as the Controversy in itself has an argumentative structure and allows the participants to get used to a "historian way of thinking" (Bruner 1996; Heimberg 2002).

As designers of the activity and "teachers," our pedagogical goals were to invite participants to enter into a historical perspective, distant from them in terms of an interpretative system of references. Students were expected to elaborate a broader picture of this period. The students who participated in this activity were interested in experimenting with argumentation through Digalo and did not know this historical Controversy before the activity. Their objectives were double: testing a new tool that can be useful in a learning setting as well as learning about a specific historical period they did not know.

Design of the learning activity

The argumentative activity mediated by Digalo contains the following main steps (Fig. 2):

(0) *Training session with Digalo*. Before presenting the Valladolid Controversy activity to the participants, we explained the main functions of Digalo in a familiarization meeting (4 computers were at the students' disposal so they could explore the software).

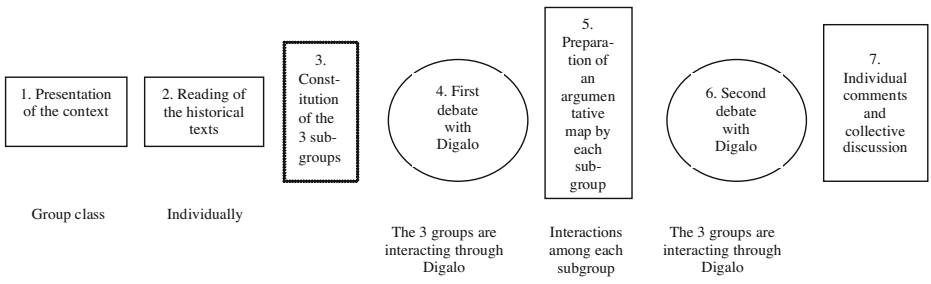

Fig. 2 Learning activity phases

(1) *Presentation of the historical context of the Valladolid Controversy*. One of the students presented to his colleagues the main issues of the Valladolid Controversy: who are the main characters of the Controversy and what was at stake in the discussions from a political and economical point of view. The question Sepulveda and Las Casas had to discuss is tackled: "Do the Indians have a soul? Are they human beings"?

(2) *The class is split into three subgroups*. One subgroup is asked to play the character of Sepulveda, supporting the perspective that Indian people don't have a soul (four students); another subgroup will play the role of Las Casas, supporting the pro-Indian perspective (3 students); and the third subgroup plays the Indian people's role (4 students);

(3) *Individual reading of historical texts*. Provided by the historian designers of the activity, the documents provide historical information allowing the participants to develop the perspective of the character they have to play.

(4) *Collective debate supported by Digalo*. All the three groups interact through Digalo about the question "do Indians people have a soul?". A first argumentative map called "map1" is the product of this debate (each subgroup has one computer to work with; 3 computers are thus interconnected). The term "collective debate" means inter-group dialogue in which all the three groups are dialoguing and arguing through Digalo.

(5) *Subgroup argumentative mapping*. Each subgroup is asked to work on historical texts and to elaborate an argumentative map with Digalo made of the main arguments they gather from their documents; this map should help them to prepare for the last collective debate. Three argumentative maps are thus elaborated, made with Digalo in an asynchronous way, resulting from the collective work of each character-group but without interaction between the groups. We call these maps "map2.".

(6) *Collective debate with Digalo*. All three subgroups interact for the second time about the same question through Digalo, but have at their disposal the maps they made in the previous step. The result of this debate is called "map3."

(7) *Individual reflection*. The participants, individually, write down their own comments, mainly about what they learned and what they think about the technical aspects of Digalo; a collective discussion then ends the activity.

From the moment when the subgroups begin working on the texts, there is no face-to-face interaction between the Las Casas, Sepulveda and the Indians subgroups.

During the Digalo sessions, the software was configured without any moderator[2]; seven kinds of shapes and three kinds of arrows were available (opposition, support and neutral arrows).

The argumentative maps produced by the groups during the collective debates take the following aspects (Figs. 3 and 4):

Methodological approach

In CSCL literature, three traditional methods of research are usually used: experimental, descriptive and iterative designs (Suthers 2006). The present study belongs to the descriptive approach: data-driven, seeking to discover regularities in data, rather than

[2] As organizers of the activity, some of us were able to answer technical questions raised by the participants.

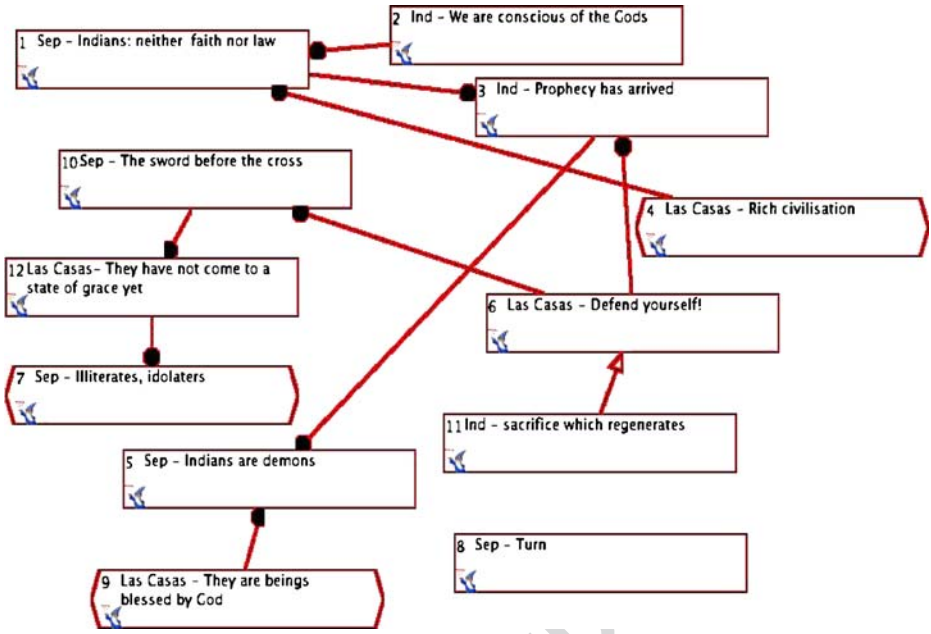

Fig. 3 Map 1 (translated in French; the name of the character has been added in the English version)

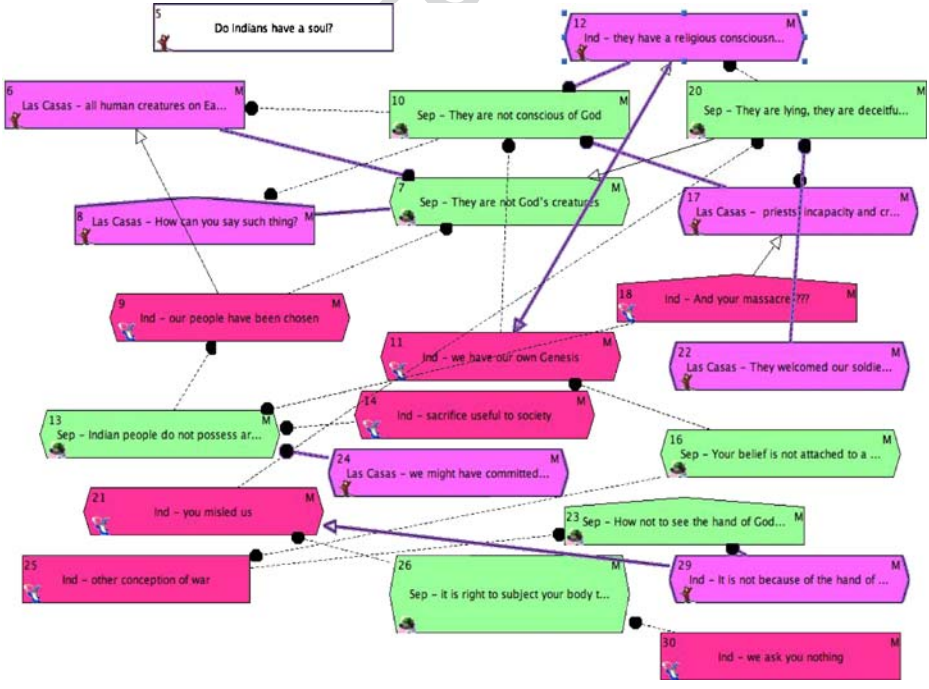

Fig. 4 Map3 (translated in French; the name of the character has been added in the English version)

imposing theoretical categories. In this perspective, our objectives are to describe how learners use a particular tool intended to mediate learning and argumentation, and in what kind of meaning-making processes they are involved. We will conduct a micro-analysis of a collective argumentative activity based on the use of Digalo. The main data we will study are, therefore, the collective argumentative maps.

Method of analysis

Our interest for interaction and learning processes (see, for example, Perret-Clermont 1980; Perret-Clermont et al. 1991, 2004; Tartas et al. 2004) caused us to move from an analysis of a face-to-face interaction to an analysis of the learning context, considered as a micro-history of a wider history of learning (see also Muller Mirza 2005; Muller and Perret-Clermont 1999; Perret-Clermont and Schubauer-Leoni 1981) that takes into account the parameters of this learning context.

In this perspective, our aim is to shed light on the dynamics of argumentation and of knowledge co-construction. Therefore, we wanted to find an analytical method that was reliable and compatible with our theoretical perspective and specificities of the online learning environment. Moreover, it had to be coherent with our pedagogical goal, which was not to teach students how to argue, but to provide them with the opportunity to learn from argumentation. While Toulmin's elaboration of argument (1958) is one of the most cited methods, in general, for argumentation's assessment, it was not useful for us; this specific "argumentation grammar" does not consider both sides involved in argumentation and its contextual specificities (Andriessen 2006). In another theoretical frame, discourse analysis would not be suitable to analyze the argumentation when supported by software (Suthers 2006). Along with others, we decided to focus on two particular dimensions that are de facto interconnected: (1) the topic construction made by the participants—what we call "topic meaning-making-oriented level of analysis"—on one hand; and (2) on the argumentation processes, "argumentation-oriented level of analysis," on the other. In our analysis, the uses of the Digalo affordances are analyzed at both levels, as they are part of the process of knowledge construction and of argumentation.

(1) Topic meaning-making-oriented analysis is based, in this context, on the following question: what are the "topic meaning-making" units that are expressed and developed by the participants about the historical context of the Controversy? Our focus will be (a) on the contents of the utterances written down in the shapes-what are the main subtopics that are brought by the groups, and (b) on when they appear in the course of the discussion. It includes what is being written by each subgroup in order to justify their position towards the question of the Indians' soul through a micro-historical level of analysis. This analysis focused on the unit of the "shapes" in tool-oriented terminology.

(2) Argumentation-oriented analysis focus on the interactive dynamics: how do participants articulate their arguments toward others? How do they take into account arguments formulated by others? Our main interest is to consider argumentation activity as a social process. In this perspective, we choose the unit of analysis suggested by Leitão (2000). Leitão is interested in tracking knowledge building through argumentation and mostly the processes of changes in people's view. In this perspective, she identifies what she calls the "argumentative sequence" (arguments-counterargument-reply) and analyzes the different ways people counterargue and reply to an argument. An argumentative sequence is made of 1) an argument, which is composed of a position and its justification, (2) a counterargument in response to the

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first argument, and (3) a reply that captures the participants' immediate and secondary reactions to the counterargument. Forms of counterarguments are of particular interest as opposition prompts the arguers to produce more explicit and better sustained arguments. She qualifies three kinds of counterarguments: (a) supporting the other side of the question; (b) bringing the truth of a claim into question by making a claim that potentially reverses what that claim comprises; (c) questioning a reason-position link.

As said by Leitão, the ability to reply to counterarguments is important in argumentation, as it reflects people's ability to consider favorable and unfavorable ideas about a given matter, as well as to examine the weaknesses and strengths of justifications they present in support of their own beliefs. It also shows how participants incorporate unfavorable data into their discourse (if they do so), which allows for changing their representation of a specific topic. For our concern, this dimension is interesting in order to see if the students make their characters change their mind. Leitão presents four types of reply: (a) the dismissal, where the participants dismiss a piece of information a counterargument conveys; (b) the local agreement: there is a partial agreement with the counterargument even if it does not lead the arguer to review or modify the first argument, and the speakers go on defending their previous position. These two kinds of reply imply the preservation of the first argument as it was originally stated, whereas (c) the integrative reply, shows the arguer's agreement with parts of a counterargument; it implies some changes in her original position (for example, the content of a counterargument can be integrated into the participants' argumentation as an exception to a point they had previously made in a generalized way); and (d) the withdrawal of an initial view.

In this argumentation-oriented analysis, the uses of some specific functionalities of Digalo—in particular the "title" and the "comment" windows, and the arrows—which are supposed to support specific forms of argumentation, have been analyzed in depth.

Data

The present data is composed by the two collective intergroup maps, maps 1 and 3. Both are collective debates, but occurring at a different moment of the argumentative activity. The first debate is organized just after a quick individual reading of the documents, while the second one takes place when the three groups have had time to prepare their arguments from their interactive observation of the historical texts. The researchers took notes when observing the argumentative activity, but for technical reasons no video tapings are available. The student accounts written down at the end of the activity and the oral discussions within each subgroup are not taken as objects of our analysis here, as we are interested on the argumentation process that has evolved through the use of Digalo. Before introducing the activity, some preliminary questions were asked to make sure that the students did not know the Valladolid Controversy.

Topic meaning-making-oriented level of analysis

The topic under study is the historical event delimited by the question: "do Indians have a soul?". We call "subtopics" the topic meaning-making units communicated by the groups through the shapes of Digalo.

Before entering into the collective debate, the groups of students read the texts. They were then invited to initiate a debate by role playing one of the three main characters of the

Valladolid Controversy. From their readings (phase 2) and their preparatory work (phase 4), how do they elaborate a picture of this historical event? What subtopics do they bring and explore in the discussion mediated by Digalo?

First, we can observe from the map1 and map3, that there are only 3 utterances (out of 35 shapes) that do not address the topic in a direct way. The others are all focused on the task. Another observation worth noticing is that each character-group of students is playing its role. This means that they use knowledge coming out of the historical context and take seriously the instructions that demand they not express their own representation about the topic, but to consider the one the characters had at this time.

The various elements that were chosen by the different groups to answer the question of whether Indians have a soul or not can be related to three main subtopics. These are all relevant for understanding of the historical context of the Valladolid Controversy.

We categorized all the utterances into the three following subtopics:

(1) *Indian civilization*. This subtopic consists of utterances from the different groups addressing the Indians' ways of thinking, believing and behaving.
(2) *Spanish spiritual representation of the world*. Related to this subtopic are all utterances linked to the way Spanish people refer to the Christian/Catholic religion, using quotations from the Bible and general "Christian morality."
(3) *Relationship between the Spanish people and Indians*. This subtopic relates to the utterances made mainly about the Spanish practices towards Indians;
(4) *Other*. A fourth category comprises utterances that cannot be related to the three previous ones; utterances that are outside of the task or do not have any content-oriented focus.

The unit of analysis is inside a "shape," a group of words sharing the same meaning; it can be one or two sentences or one part of a sentence, according to its meaning.

We can see that the different subtopics are addressed in different ways in these two maps (Table 1).

Let us consider the way participants make use of the different subtopics in the two maps.

"Indian civilization" subtopic as a shared meaning-making unit

The subtopic of the "civilization" of the Indians is addressed both by Las Casas and the Indian subgroups in order to support the position that Indian people can be considered as human beings and God's creatures. This subtopic is very often addressed in the first map (50% of all the utterances) and decreases in map3 (30.4%). The Las Casas subgroup, for instance, expresses the idea that as human beings they have developed a complex society built on some sophisticated judicial and clerical systems: "They have laws—they are

Table 1 Number and percentage of meaning-making oriented units used in the map 1 and 3

	In map1	Percent	In map3	Percent
Subtopic 1 (Indian civilization)	7	50	7	30.4
Subtopic 2 (Spanish representation of the world)	3	22	4	17.4
Subtopic 3 (relationship between the Spanish people and Indians)	0	0	9	39.2
Others	2 (+2 out of task)	28	2 (1 out of task)	13
Total	14		23	

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Table 2 Argumentative sequences in map1 (extracts) t2.1

Turns	Character	Argument (A)	Counterargument (CA)	Reply (R)	Justification	
Argumentative sequence 1 (Indians' consciousness of God)						t2.3
1	Sepulveda	A1a: They are not conscious of God			Because they have no physical modesty; they are naked	t2.4
2	Indians		CA1a: We are conscious of the Gods (dismisses A1a in supporting another side of the question)		because we accept the prophecy of destruction and we offer sacrifices to calm their anger (the notion of sacrifice is used as a data grounding the fact that Indians are conscious of God)	t2.5
4	Las Casas		CA1b: They have a religious consciousness (dismissing A1a in supporting another side of the question)		they have created a civilisation with complexes religious and laws...	t2.6
7	Sepulveda			R: How can we call this civilisation (dismissal reply; it addresses both counterarguments from the Las Casas and Indians groups)	They sacrifice human beings from their own people!	t2.7
11	Indians		CA: Sacrifice which regenerates (counterargument to A1, but comes directly in opposition to Sepulveda's group reply; it brings the truth of the claim into question)		for the well-being of our people, for good harvests, our group has priority over the individual we sacrifice combatants prisoners as did great civilisations before us	t2.8
Argumentative sequence 2 (Creature of God)						t2.9
5	Sepulveda	A2: Indians are demons. They cannot be creatures of God			they have all the vices	t2.10
9	Las Casas		CA2: They are beings blessed by God (simple dismiss)		Following Isaac's sacrifice, God declares that all nations on Earth are blessed	t2.11

Table 2 (continued)

Turns	Character	Argument (A)	Counterargument (CA)	Reply (R)	Justification
10	Sepulveda			R2a:One should at first chase the demon from within yourselves before you can be pacified (integrative reply)	
12	Las Casas			R2b: They have not come to a state of grace yet	They have an alphabet, a very precise calendar. As for about human sacrifices, they will stop right away as soon as we have converted them

admirably policed—and a very demanding religion. Places of worship, priests" (Las Casas subgroup, map1).

The Indians subgroup, making reference to the specific mythological and spiritual representations of the Aztec people in this historical period, gives some information about this dimension. For instance, in map1 when they explain: "We are conscious of the Gods, because we accept the prophecy of destruction and we offer sacrifices to calm their anger."

If this subtopic is also discussed by the group of Sepulveda, it is, of course, to express their disagreement. In short, their main argument is to say that Indians cannot be considered as "civilized" people since they sacrifice members from their own community.

On this point, the Indians subgroup gives many elements in order to justify their position or to make it the most "reasonable" as possible. In map3, they develop and add relevant points about this subtopic; for example: "Our people have been chosen to nourish the fifth Sun by our sacrifices. He needs our support for his battle against the stars and the moon. It is the way we honor him." They try to convince the other groups that their human sacrifices are justified by their own cosmogony. Making this point relevant, they thus bring important meaning-making units into the debate.

"Spanish spiritual representation of the world" subtopic as a shared meaning unit

In order to support their claims, both Las Casas and Sepulveda groups, in their argumentation, are using elements from the situated-culturally and historically position of the Spanish people living in the 16th century. The Las Casas subgroup, for instance, makes reference to the Bible and Isaac's sacrifice by Abraham to remind that Christians, in a way, also have integrated the human sacrifice as a religious practice. In contrast, the Sepulveda subgroup makes reference to a kind of Christian morality, but for sustaining the opposite position, when they claim that "They are naked, thus they are not conscious of God, because they have no physical modesty" (map1), or when they write "Indians are demons. They cannot be creatures of God. They have all the vices" (map1).

It is of interest to note that this "moral" dimension becomes an object of discussion in map3. To the argument, as formulated by the Sepulveda subgroup, saying "They are not

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conscious of God. They are unable to assimilate catechism and chastisement," the Indians subgroup replied "If we do not recognize chastisement as you conceive it, it is simply because it goes against our own beliefs." The students playing the Indians role are making an important point here. They make salient the relativity of these positions—all arguments, and maybe all practices, are to be understood in the cultural and historical context in which they are expressed. This point thus appears very relevant in the learning activity itself, as one of its goals is to make pupils aware that the positions that were discussed during the Valladolid Controversy were historically situated, and that it is one of the historian's missions to make this context more understandable for people living in another period of time.

"Relationship between the Spanish and Indian people" subtopic as shared meaning unit

It is worth noting that if meaning-making units about Indian and Spanish Weltanschauung are elaborated in both maps, only in map3 is the topic of the relationships between Spanish and Indians stressed.

This new subtopic was introduced by the Las Casas subgroup when writing down: "our priests' incapacity and cruelty. They force Indians to submit to religion; otherwise they burn or hang them" (turn 11, map 3, see Table 3). Since the initial question was focused toward the Indians' soul, it is now the Spanish practices and "morality" that are discussed.

The Indians subgroup benefits from this intervention and adds their own claims: (turn 12, map 3, Table 3) "And your massacres??? We have an eschatological justification for our sacrifices. But you, you torture us, slaughter our women and children in God's name of love, goodness and pardon. Is this not a paradox?". In making this point, they say at least two things: that Indian people have a kind of "consciousness of God" (that point was put into question in the beginning of map3 and mostly in map1) as their own sacrifices have an eschatological justification; and that Spanish people behave in a contradictory way by the fact that they say that they come and display a religious message full of love, but they only provide sadness and horror.

This new subtopic actually introduces a double shift in the debate: a shift in topic focus—from a focus on defining Indians' identity, the discussion is moving toward the practices of Spanish people—and a shift in the dialectical roles: Spanish people who were the accusers are now becoming the accused. This shift in the evolution of the debate can be seen as leading to inquire into the initial question and its legitimacy: is it legitimate that people who behave in such an (inhuman) way can question the humanity of other people? This meta-reflective activity, brought about by the Las Casas subgroup and followed by the Indians subgroup, appears here also as an interesting argumentative strategy, calling into question the initial dialectical position of the Spanish actors.

Moreover, in map3 the implicit issues of the Controversy are addressed, in particular by the Indians subgroup when they write: "you are pretending to bring to us civilisation and Christianism, while you turn us into slaves and are interested first of all in pillaging our wealth" (turn 14, Table 3). It is true that behind the philosophical discussion about the "humanness" of Indians, the very issue for the Spanish King was to know if it was still possible to keep them in a slave position while taking advantage of their rich territories.

In this analysis, we can see that a broad and deep picture of the historical event has been elaborated by the character-groups in both maps; participants developed pieces of knowledge about both Indians and Spanish ways of life and thinking. The possibility that is given by Digalo to return to what has been said previously allows participants to go deeper into the topic meaning-making process. This result joins some CMC studies where the role of external representations allows return to prior information (for example, Suthers

Table 3 Argumentative sequences in map3 (extracts) t3.1

Turns	Character	Argument (A)	Counterargument (CA)	Reply (R)	Justification	
Argumentative sequence 1 (Creature of God)						t3.2 t3.3
1	Las Casas	A1: All human creatures on Earth are blessed by God			See Genesis chapter 22 after Isaac's sacrifice	t3.4
2	Sepulveda		CA1a: They are not God's creatures (simple dismiss)			t3.5
3	Las Casas			R1: How can you say such thing? (dismissal reply)		t3.6
4	The Indians				Our people have been chosen to nourish the fifth Sun by our sacrifices. He needs our support for his battle against the stars and the moon. It is the way we honour him. (opposition to CA1 proposed in turn 2 by Sepulveda)	t3.7
Argumentative sequence 2 (consciousness of God)						t3.8
5	Sepulveda	A2: They are not conscious of God			They are unable to assimilate catechism and chastisement	t3.9
6	Indians		CA2a: We have our own Genesis (brings the truth of the claim into question)		If we do not recognize chastisement as you conceive it, it is simply because it goes against our own beliefs	t3.10
7	Las Casas		CA2b: They have a religious consciousness (brings the truth of the claim into question)		They have temples, priests and religious practices	t3.11
8	Sepulveda			R2: Indian people do not possess art and ways of humans (reformulating A2 and dismissing CA2a &b)	You sacrifice human beings	t3.12

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Table 3 (continued)

Turns	Character	Argument (A)	Counterargument (CA)	Reply (R)	Justification
9	Indians		CA2a'2/R2: Sacrifice useful to society (gives new pieces of information to CA2 and brings the truth of A2 into question, and is in opposition to R2)		Our sacrifices aim to regenerate our Sun god. One single human sacrifice brings 52 years of life to the whole of our society
10	Sepulveda			R2' Your belief is not attached to a unique God (integrative reply)	
Argumentative sequence 3 (Spanish practices)					
11	Las Casas	A3a: Our priests' incapacity and cruelty			They force Indians to submit to religion otherwise they burn or hang them
12	Indians	A3b: And your massacres???			We have an eschatological justification for our sacrifices. But you, you torture us, slaughter our women and children in God's name of love, goodness and pardon. Is this not a paradox?
13	Sepulveda		CA3 :They are lying, they are deceitful and have betrayed Spanish people		The greater they become, the worse they become and no justice prevails among them. This sign shows that they are not creatures of God
14	Indians		You mislead us (opposition to CA3 that bring into question a reason-position link)		You are pretending to bring us civilisation and Christianism, while you turn us into slaves and are interested first of all in pillaging our wealth

et al. 2006). The shapes, in their visible and stable form, render salient an idea to all the participants, and allow them to better identify what arguments are still missing.

We also observed that map3 shows a very complex level of understanding. The participants probably had some benefits from their subgroup working on the historical texts

(phase 3). These benefits concerned knowledge about the historical characters, as no student knew at the beginning of the activity about this historical event. Through their individual reading and subgroup working they were able to go deeply into the topic. But they were also getting more familiar, at this point, with the Digalo tool, which allows them to make their reasoning visible not only for the others, but also for themselves.

The question about the Indian's soul is thus discussed by the character-groups, and in the discussion each of them are engaged in an exploratory work of subtopics that are relevant for a better understanding of this historical period. How is this picture developed through the argumentative dynamics?

Argumentation-oriented analysis

In order to better understand how the argumentative dynamics evolve in the maps, we observe here how the arguments-counterarguments-reply (A–CA–R) sequences are being developed. Let us take one example extracted from map1 which is represented in Table 2.

In both maps, we can observe that each claim is justified and is the object of at least one counterargument. The oppositions are not simple dismissals and often take quite complex forms. A real effort is made by the participants to articulate the ideas to each other. In general, sequences end with replies that can be assimilated to dismissal, in Leitão terminology, but sometimes by integrative reply, as the arguers take into account the counterargument the others have suggested and add a nuance to their initial claim. Neither a local agreement nor a withdrawal has been explicitly formulated by the character-groups. We can also notice that the argumentative sequences do not follow a chronological order, meaning that participants have taken the benefit of the written and stable form of the discussion and have constructed their arguments and counterarguments on the basis of the whole picture the Digalo argument maps provided.

In map1, the sequence A–CA–R has been present through the whole discussion, but the characteristic of this first map is that the Sepulveda subgroup took an important role in the discussion. It is this group who initiates each sequence and takes the role of "accusers." This group proposed two main arguments in order to defend the position that Indians are not human beings: Indians are not conscious of God, and they are not creatures of God. There were not so many arguments, but it is of interest to note that even if the groups of students were not very much prepared at this step of the activity they engaged in the debate, and many of their propositions not only are linked to each other in terms of contents, but are also linked with arrows. The Las Casas and Sepulveda subgroups, in particular, often return to the arguments written by others, adding information or proposing other justifications or examples.

The discussion (Table 2) began with an argument given by the Sepulveda subgroup. Then the Indians subgroup (turn 2) qualified Sepulveda's argument with a counterargument, and the Las Casas subgroup went even further in the counterargument. The reply given by the Sepulveda subgroup (in turn 7) is a dismissal: their initial vision of the Indian people has not been changed. Their response returns to the question of human sacrifice (initiated by the Indians subgroup themselves), which is then re-addressed by the Indians subgroup (turn 11) and who add an important element: Indians do not sacrifice their own people but war prisoners.

It is also the Sepulveda subgroup who proposed the second argument (turn 5). This second argumentative sequence ends with an utterance that can be interpreted as a integrative reply, as it provides a nuance in comparison with their initial claim ("Indians are demons" to "one should first chase the demon from within yourselves").

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So, the students, at this first step, manage to give arguments and counterarguments, focusing on the task and co-constructing a shared meaning as they take into account other positions and place links between their contributions and others. The arrow function provided by Digalo is used here to sustain the interconnection of the utterances, and contributes to make a complex argumentation network; this tool, as it is used, seems to prevent participants from only juxtaposing their arguments; it also seems to help them to think about the argumentative consequences of each claim and, therefore, go deeper into the general topic.

The same grid has been used for the analysis of map3. We can see in Table 3 how the argumentation develops during the last collective debate after the work in each character-group.

In map3, what is interesting to observe (see Fig. 4 and, for an extract, Table 3) is that the groups justify more and more their positions as they elaborate content through a complex pattern of A–CA–R. Map3 began with a first argumentative sequence where the Las Casas subgroup initiated the discussion with an argument that was quickly countered by the Sepulveda subgroup, which was dismissed by the Las Casas subgroup (turn 3). The Indians subgroup continued with an utterance that can be seen as an opposition of the Sepulveda subgroup's CA1 (in turn 2). Then a more complex argumentative sequence is developed. A new argument ("they are not conscious of God") is proposed by the Sepulveda subgroup (turn 5) and the Indians subgroup then developed a first counterargument (CA2a); a second one is developed by the Las Casas subgroup (turn 7); and then a reformulating reply is made by Sepulveda (R2:" Indian people do not possess the art and ways of humans"). In this reply, Sepulveda group reformulates, in a sense, their first argument (given in turn 5) by going deeper in their explanation (Indian people are not conscious of God as they are able to sacrifice human beings). This argumentative sequence continued on with another counterargument (turn 9, CA'a/R2), proposed by the Indians subgroup, that relies on the reformulating reply R2 given by Sepulveda (the response CA'a is directed toward the R2: "sacrifice useful to society"). The Sepuvelda subgroup then proposes a reply (R2') that can be seen as an integrative reply: "Your belief is not attached to a unique God" (it is a modification of their initial claim that Indians are not conscious of God). So, there are complex sequences of argumentation that emerge through a co-constructive way of debating. Sometime one single argument is the object of five or six turns of writing. The way argumentation evolves reveals complex patterns where returns and other references to previous utterances are developed in a non-linear way of discussing. In this sense, we can say that participants have managed to develop their argumentation and to broaden their justifications in relation with others.

In this map, the Indians subgroup always used the information provided by Sepulveda against their humanity to transform it into a counterargument or a justification that integrated their opponent's point of view. The Las Casas subgroup played a major role between the two opposing groups by reformulating the Indians' position as well as the Spanish's. They added a very dialogic way of participating by always relying on the other's argument and trying to go deeper in the topic. They developed a sort of a mediator posture that enhanced the vision of Indians as human creatures by using Spanish people's practices as a key point to denounce the contradictory position of Sepulveda in using his own Christian cultural elements. Sepulveda's point of view is not directly dismissed, but it is implicitly.

The way by which the argumentation becomes co-constructed and develops its dynamic between map1 and map3 has probably been supported, on one hand by the intermediate phase (allowing an in-depth study of the historical texts), and on the other hand by the use

Table 4 Use of two functionalities-title and comment-in map1

Character Group	Title	Comment
Sepulveda	*Indians: neither faith nor law*	They are naked, thus they are not conscious of God, because they have no physical modesty
Las Casas	*They are beings blessed by God*	Following Isaac's sacrifice, God declares that all nations on Earth are blessed
Sepulveda	*Indians are demons*	They cannot be creatures of God. they have all the vices

of Digalo in an asynchronous way. But means is given directly by Digalo: it offers opportunities, in its materiality, to maintain others' attention, to render explicit its own point of view for oneself, as well as for the others. In order to better understand this last point, let us consider the description of the uses of some Digalo functionalities that may support the argumentative activity.

Uses of Digalo's functionalities

The uses of the functions "title" and "comment"

It is interesting to observe that the character-groups, when writing into a Digalo shape, not only express a position about the question that is at stake but also give a kind of justification for it (see examples in Table 4 for map1 and Table 5 for map3).

We can observe that both functionalities provided by Digalo for each written contribution, namely the "title window" and the "comment window," have been used. The way they have been used shows that participants made a semantic difference between them. In the "title window," they generally wrote down what we call the main "argument" or the claim, in Toulmin's terminology. They generally used the "comment window" to give a justification of this claim by making reference to observations: "They sacrifice human beings"; "They have an alphabet, a very precise calendar," or other kinds of data. In map1, the 12 shapes that represent the discussion have a real title and comment. In that way, the use of Digalo fits what the designers intended.

In map3, however, if students also use such functionalities, the uses have been developed and transformed. Indeed, these Digalo functionalities have been used in other ways. At some different stages of the debate for instance, the subgroups used the first window (the "title" one) in order to directly address their points to another character or subgroup in a dialogic way of writing. For example, when the Indians subgroup wrote as a title "And your massacres???" and as a comment "We have an eschatological justification

Table 5 The uses of title and comments in map3

Character group	Title	Comment
Sepulveda	*They are not conscious of God*	
Indians	*We have our own Genesis*	If we do not recognize chastisement as you conceive it, it is simply because it goes against our own beliefs.
Las Casas	*They have a religious consciousness*	They have temples, priests and religious practices.
Sepulveda	*Indians people do not possess art and ways of humans*	You sacrifice human beings

Table 6 Number and type of arrows in maps 1 and 3, according to the character group

	Total		Sepulveda		Las Casas		Indians	
	Map 1	Map 3	Map 1	Map 3	Map1	Map3	Map1	Map3
Number of arrows	12	28	6	9	3	9	2	10
Opposition	11	21	5	8	5	6	2	7
Support	0	6	0	1	1	2	0	3
Neutral	1	1	1	0	0	1	0	0

for our sacrifices. But you, you torture us (...)". Here the title is not so much a synthesis of what is being developed in the comment but rather has a pragmatic function of quickly saying the counterargument by using the expression "massacres" (on behalf of "sacrifices," used before by the Sepulveda subgroup[3]). A justification then appears in the comment in order to explain the Indians subgroup's point of view. Moreover, in map3, the content of the title windows is also used to give directly a developed argument with the justification, as in this example by the Sepulveda subgroup in map3: [title] "They are lying, they are deceitful and they have betrayed Spanish people" [comments] "The greater they become, the worse they become and no justice prevails among them." Title windows are also sometimes used just to stop the discussion by asking a provocative question ("And your massacres?" as the Indians group wrote), or to propose directly a counterargument without any justification (for example, when the Sepulveda subgroup writes back to the Indians, saying "You do not believe in one God").

Thus, this development can be observed while comparing how the two maps were built. In the first map, the title is really a main argument or a synthesis of it, and the comment is used to develop a point of view with its justification and explanation, whereas in map3, the title sometimes has both functions embedded. In terms of the argumentation processes, it allows others to know right away the position of the speaker-writer. We do remark that the functionalities, as designed for a specific use by the tool's developers, can be reinterpreted by participants across the discussion; the more they get familiar with the tools, the more they use them in a "personal" way. Digalo also offers to users these possibilities of appropriation.

Some examples of the use of the title in map3 (see Table 5) by the different character-groups reveal a higher level of variation for the uses of the titles and comments windows. The titles are more often used as a counterargument, while the comments focus on justifications based on examples or other information. We also observed there, with great interest, that the titles and comments windows increased the dialogical way of debating, which was lacking in map1. For instance, the way to write to the Indians subgroup was no longer as "they" but "you." Also, sometimes some dialogical marks are present from the title and repeated in the comment, as in this example from the Indians subgroup: [title] "We have our own Genesis"; [comment] "If we... you...".

This allows us to conclude that through the use of Digalo's functionalities, the subgroups moved from "talking about" to "talking to" the other, showing that not only were they able

[3] This "translation" actually seems to be a good argumentative strategy, as it indicates that the same end result—men and women are killed—is referring to different meaning universes: the first one ("massacre") has no reason except the cruelty of the killers; the second one ("sacrifice"), has a transcendental and holy dimension.

to use the tool in a dialogical way to articulate their perspectives to each other, but also to identify themselves with their characters.

The use of the arrows

By means of the arrows, participants have the opportunity to bring salience into the relationship between one utterance and another. We have noticed in both maps (even if in the second one the "network" is more complex), that none of the shapes remained isolated; all are linked with at least one other shape. There are 12 arrows for 12 shapes in map1, and 28 arrows for 22 shapes in map3. It is the opposition arrows that have been mostly used (Table 6).

These results show that the uses of functionalities have been developed through the activity. In map3, contrary to map1, each subgroup has used arrows in an equivalent way mainly in order to mark their opposition, but also to link their own propositions to others. This shows how learners acted to make understanding and meaning-making process clearer for themselves as well as for their interlocutors.

Discussion

Many studies show that argumentation activities may enhance learning due to their dialectical dimension. It allows making the point in discussion more explicit for others and for oneself, to reach conceptual changes by the means of confrontation of perspectives, to increase articulations between the different elements, and to permit co-elaboration of new knowledge. Consequently, argumentation is often seen as a powerful tool for learning. However, in school contexts, it doesn't seem so easy to bring this about. The first difficulty is to invite pupils to argue in a dialectical way. If they are generally able to express their perspectives on a topic, it seems difficult for them to develop justifications and to take into account the arguments of others.

Argumentation must be framed, scaffolded and guided, as it is often said. It appears, therefore, important to both (a) support students' thinking by providing them external representations that allow them to focus their attention on specific content; and (b) support the whole activity through phases that allow entering into a controversial topic. Toward this aim, CSCL tools, integrated into an activity that integrates different social and cognitive practices (reading of texts, small-group work, collective debates, etc.), can be of interest for argumentation and learning processes.

In this paper, we described the meaning-making processes we observed in the participants immersed in a specific phased learning activity. This activity entailed some socio-constructivist assumptions on learning development: it was sequential, took the form of a role-play, and was mediated by an electronic graphical support called Digalo. Its main pedagogical goals were oriented towards both topic and argumentative development.

In this activity, what concretely did the participants do? How did they build meanings from this environment? Did they manage to find arguments and enter into an argumentative process? Did they construct a new understanding of the topic in question?

In order to obtain answers to these questions, we adopted a descriptive and "micro-analysis" approach to two phases of the activity, specifically two collective debates mediated by Digalo that we considered "micro-histories." The first one occurs at the beginning of the activity, the second one after the study of documents. We focused our study on two main dimensions that we distinguished for the purpose of the analysis: the participants' elaboration of what we called "topic meaning-making units," and the development of an argumentative

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sequence. We were interested in how argumentation dynamics develop through discussion and how topic meaning-making units are themselves set up in these processes.

In terms of topics and knowledge units that were built by the participants, we showed that a broad picture of the historical event had been elaborated. The main dimensions were addressed: information about specificities of the Aztec civilization, contextual and historical points about Spanish people, and the relationship between both cultural groups. The topic meaning-making units give a quite complex picture of the historical context, its issues and also of the different main actors who were involved in the Valladolid Controversy in the mid-16th century. In exploring this topic through readings and argumentation, students showed that they were able not only to elaborate pieces of knowledge, but also to "de-center" them from their here-and-now perspective. They managed easily to put aside their personal way of considering the event. They showed abilities, therefore, to adopt a historian's way of working, oriented towards the study of historical documents and understanding the way of life and thinking specific to this historical period, with non-judgmental and personal consideration. We also observed that a broadening of understanding of the Controversy issues emerged in the second map.

The elaboration of this complex topic is embedded into argumentative dynamics. We studied them using Leitão's unit of analysis, the argumentative sequence (argument-counterargument-reply). From our observation, participants showed abilities not only to formulate claims and justifications, but also to make counterarguments and take them into account in their responses in an articulated and dialogical way. In this process, oppositions prompted participants to make explicit their arguments, justify them, and add new pieces of knowledge to the ongoing discussion. If the characters played by the students did not change their initial view about Indians' souls, we observed that argument and counterargument dynamics led them to concessions of a sort (at least for the Sepulveda subgroup). We observed with interest that map3 showed more dialogical traces, as if participants were more able to enter into a joint discussion at this step of the learning activity. It is also in this map that new argumentative strategies were used and that a discursive shift occurred: the character-group, Sepulveda, who were supposed to be the accusers, become the ones who are the object of attack.

These observations sustain results of previous studies on how argumentation and learning clarify learners' difficulty in engaging the argumentation process due to its cognitive and affective load. It seems that it is important to first prepare the argumentation phase with activities in order to support and facilitate the elaboration of relevant arguments. The role-play format of the activity seemed to have permitted learners to give arguments and counterarguments in a way that was not felt to be socially threatening, affectively speaking, since they did not defend their own position but the characters' (Stein and Albro 2001; Van der Puil et al. in press).

Moreover, these interactive dialogical constructions of both topic and argumentative discourse are supported by the specific functionalities Digalo affords. In our situated and interactive approach of cognition, it is not possible to separate knowledge construction and argumentative dynamics from the tools used. In this sense, the uses of the tools play an important role: the shape, in particular, leads toward a shared understanding of the topic under construction. The titles, comment windows and arrows, in the way they have been used, have facilitated the co-construction of meaning-making processes, sustaining the argumentation process. They shed light on the fact that if one expresses a claim, one must justify it, take into account what has been said previously, and focus others' attention on what has been written, for the others as well as for oneself. It is as if the use of these Digalo functionalities, even in this short period of time, led the users to broaden and deepen the topic (mainly in map3) in an argumentative way, exploring different ways to contradict an

argument, justify a position, etc. The fact that the participants can read directly on maps the history of their shared thinking may also be of influence on individual and collective levels. The shared argument map allows participants to see not only what has been built previously, but also inserts it in a process of collective reasoning. The process of co-constructing units of meaning making render them explicit to others by the use of shapes and arrows and the co-construction of ways of communicating and arguing through synchronous discussion of intrinsically interconnected items. Co-construction develops through the ongoing activity of a shared meaning-making process and argumentative discussion. It would be interesting for further studies to analyze the role of external visualization of the discussion at both of these levels. We are now in the process of adapting the Valladolid Controversy scenario for younger pupils in a school context to better grasp the development of argumentative competencies.

Argumentation and thinking are intrinsically interwoven. However, what are the methodological means that allow grasping this relationship, even more when it is mediated by an electronic device that significantly modifies the usual conversational way of arguing and thinking? It seems that taking into account an interactive unit—the A-CA-R sequence—provides good opportunities to see, in an interactive way, how the discussion is evolving and permits incorporating the co-construction of learning into argumentation even in the same turn of speech (Leitão 2001; Marková 1990). For this analysis, we distinguished two dimensions: topic meaning-making and argumentation dynamic. If this distinction appears artificial, the results it provides give cues to a better understanding of their interconnectedness. In the continuity of Suthers (2006), we could talk about an intersubjective meaning-making-oriented level of analysis comprising both topic meaning-making and argumentative-oriented levels.

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