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## Building intersubjectivity in blended problem-solving tasks

Rossana Beraldo<sup>a</sup>, Susanna Annese<sup>b</sup>, Neil Schwartz<sup>c</sup>, M. Beatrice Ligorio<sup>b,\*</sup><sup>a</sup> University of Brazil, Brazil<sup>b</sup> University of Bari, Italy<sup>c</sup> University of Chico, USA

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### ABSTRACT

This paper aims to shed light on the process of building intersubjectivity between student-student dyads in a blended educational context. Three girls and five boys, 17 to 18 years old, participated in two types of problem-solving tasks. They formed four dyads and were required to negotiate aloud what to post in a web-forum. Dyads were video recorded, with eight sessions in total. The same pairs participated in both tasks. We are interested in understanding how the intersubjective processes were affected by the tasks and by the dyads. The two tasks differ concerning the structure of the problems. The first task was based on two short papers – one *pro* and other *con* – referring to a problem close to students' real life: the use of digital devices in class. The second problem was based on perspective-taking: dyads were required to imagine “How would the school of the future look in 20 years.” Data were analysed through a purpose-built codebook, comprising five macro-categories and 21 subcategories. Altogether, our results indicate an effect of both the type of task and of dyads' specific style of interaction. Nevertheless, a five-step process featuring intersubjectivity was found. Practical implications for teachers and educators are highlighted.

## 1. Introduction

The Pandemic crisis opened a new window to integrate digital resources in Education. Despite many efforts to include technology over the last two decades, the social isolation caused by Covid-19 found Brazilian schools —as in many other parts of the world — unprepared in facing the request to interrupt teaching and create technology-based alternatives to replace the classes. This situation highlighted a gap between the general consensus about educational digital technologies as capable to promote interaction, collaboration, and co-production (see for instance the literature on Computer Supported Collaborative Learning - Stahl, 2002) and the real conditions under which teachers and students embed technology in their daily practices. A better understanding of how communicative and socio-cognitive processes develop is needed, especially when students are required to perform blended tasks, namely tasks during which online and face-to-face interactions are mixed. This is needed since the blended approach seems to be the most promising in the post-Covid scenarios.

To gain a deeper understanding of blended tasks, one of the processes we believe is crucial is the construction and development of intersubjectivity. This is a concept with many definitions and nuances but always recognized as central for learning, in particular when social interaction takes place. It can be useful to unpack what intersubjectivity is and how it evolves during the accomplishment of an educational blended task. In the following sections, we first outline the most predominant definitions of intersubjectivity. Later, we

\* Corresponding author.

E-mail address: [mariabeatrice.ligorio@uniba.it](mailto:mariabeatrice.ligorio@uniba.it) (M.B. Ligorio).

focus on the features of collaborative problem-solving tasks performed by using a web platform as a communication system. Finally, we present our research focused on comparing two types of collaborative problem-solving tasks performed by dyads working in the presence of one another, while also interacting with other students at a distance through a web-forum.

### 1.1. Defining intersubjectivity

The concept of intersubjectivity relates to the ability to construct meaning with others (Rogoff, 1990). It relates to the way people share, negotiate, and produce the meaning of what they do together, how they let other people know what they are doing, and how they understand and take into account what others are doing. Intersubjectivity is disclosed by the way participants: (a) coordinate their individual contributions in the joint activity of sense-making (Matusov, 1996), (b) attempt to define the meaning of the context (Rommetveit, 1979; Wells, 1993) and (c) develop their own individuality and accept the individualities of the others (Matusov, 2001).

For these reasons, an examination of intersubjectivity is crucial in education. Bruner (1986) stated that intersubjectivity is one of the most typical human processes and education should ground its action in it. Following this recommendation, educational research attempted to better exploit how intersubjectivity takes shape within learning contexts. Despite the ways researchers looked at the construction and development of intersubjectivity, there is substantial agreement in considering dialogue and discourse as a fundamental 'place' to observe how intersubjectivity originates and evolves, and what dimensions are shaped by and contribute to it. Discourse is the process of interweaving individual contributions: its sense is not in each individual utterance but in the coordination among different interlocutors' positions, which is the intersubjective space (Traetta & Annese, 2012).

When analyzing dialogue among participants as a medium to build intersubjectivity, Rommetveit's (1976, 1979) contribution is essential. He argued that intersubjectivity is a multifaceted reference system guiding individuals during interactive activities. He believed that a state of complete intersubjectivity is never reached as it is not clear at exactly what point it arises and closes; after all, it is an endless process. In his opinion, several processes reveal the complexity of its development and its multidimensional nature. Therefore, intersubjectivity is temporary and partially shared in a plurality of communication and socio-cognitive processes abiding by specific laws. As a result, breaks, misunderstandings, and dissonances indicate how dependent we are on the discourse of another to make sense of what is going on (Linell, 2009). Rommetveit adds also that the sense-making activity associated with the intersubjective process may concern the way participants position themselves and represent themselves.

Matusov (2020) sees intersubjectivity as part of a genuine dialogical pattern involving the ontology of participants and the emerging of their values and virtues during the discursive activity. By analyzing how intersubjectivity evolves during discursive interaction, it is possible to understand: (a) the individual orientations (Mercer & Wegerif, 1997), (b) the quality of the relationships within a classroom (Wells & Arauz, 2006), which does not necessarily imply agreement about the concepts discussed (Matusov, 1996), and (c) the level of participants' involvement (Ligorio, Cesareni, & Schwartz, 2008).

The research studies about intersubjectivity in computer-supported activity confirmed the focus on dialogue and added new features (Bober & Dennen, 2001). In particular, the space-time dimension is perceived in an original way (Gilje, 2019; Pifarré & Staarman, 2011; Ritella, Rajala, & Renshaw, 2020; Wegerif, 2001). This perception is not confined to the digital environment but it also changes the way face-to-face space-time is perceived. The digital space becomes an additional layer including and impacting the physical space. Similarly, time online may have a specific pace —depending on the tool used— that may impact the management of offline time (Beraldo, Ligorio, & Barbato, 2017). The reconceived dimensions of space and time can produce a polyphonic texture in the intersubjective system (Barbato & Beraldo, 2020).

Stahl (2016) looks at intersubjectivity in computer supported collaborative learning through small groups activity. In those units, intersubjectivity both influences and is influenced by individual and collective understanding. According to Stahl (2016), the computer mediated communication is able to give the group a multimodality of learning through multiple layers of information. Chats, for instance, are linear writing tools not allowing the deletion of the messages; here symbols, emoticons, abbreviations, images, and links can be integrated, influencing how the intersubjective space is built (Trausan-Matu, Stahl, & Sarmiento, 2007). When technology supports efficient, deep, and long-lasting learning, it means that participants have more time and possibility for planning, negotiation, elaboration, implementation, discussion and reorganization of information and ideas. This multilayered learning process surely influences the individual and collective instances of intersubjective space (Ligorio, Talamo, & Pontecorvo, 2005).

One general conclusion upon which research with and without the use of a computer seems to agree is that intersubjectivity is context sensitive. The content, the temporal dimension, the participants' identity and values, and the tools used, are all elements that influence and are influenced by intersubjectivity.

In this paper, we are particularly interested in looking at a specific type of task – problem-solving – and at the blended condition within which students are required to collaborate. Therefore, in the next section, we will discuss some empirical studies about the processes underlying intersubjectivity in problem-solving tasks.

### 1.2. Problem-solving task and strategies for building intersubjectivity

The reason we focused on a problem-solving task is because it has been considered by many authors as able to trigger and unpack intersubjectivity. The formulation of arguments and narratives orienting problem-solving tasks, mobilizes the known and the new when analyzing the situation and proposing possible solutions (Vandermaas-Peeler, Westerberg, & Fleishman, 2019). In this way, participants are individually and collectively involved in the production of meanings, which is the core of the intersubjective system.

Hakkarainen and Sintonen (2002) observed how discursive dynamics and explorative practices are used in a problem-solving task. Their observation found that, while searching for information, students gradually co-constructed a non-authoritative intersubjective

space where new knowledge building can occur. The starting point was a general question that students were required to answer based on their own knowledge. This opened up possibilities of widening the space for intersubjective exchanges.

Some authors (Scheuer, McLaren, Harrell, & Weinberger, 2011) examined argumentative online problem-solving tasks on the ethical dimension of global warming that were assigned to graduate students working in dyads. They found that when students were able to have a structured collaboration, they reached a deeper involvement in critical thinking, argumentation, and a higher level of intersubjectivity.

Working with slightly different tasks—a culturally sensitive nationalistic problem—specifically, whether the Annan Plan was an appropriate path to take in the reunification of Cyprus, Angeli and Schwartz (2014) found different processes of intersubjectivity depending not only on the level of previous information about the problem, but also on the participants' cultural background, and prior experience.

Barbato and Beraldo (2020) showed that context-sensitive or ethics-sensitive issues can influence problem solving processes in learning activities since the self, the other, and the context students live in are included in the intersubjective process needed to negotiate a solution to the problem under discussion. Real-life problems close to student's interests can provoke high engagement and, when collaboration is triggered, allow the emergence of a fine tuning of the intersubjective process.

The results of these studies led us to reason that problem-solving has the potential to prompt specific intersubjective processes. Therefore, we decided to design two different problem-solving tasks to demonstrate this potential.

## 2. The research

### 2.1. Aims and research questions

With this research we intend, by a comprehensive descriptive strategy, to look closely into the process of building intersubjectivity within dyads performing two different types of problem-solving tasks. Both tasks require two students working in a dyad to negotiate and finally agree on what to post on a web-forum used by a larger group of students. Therefore, our research questions are:

1. How is the process of building intersubjectivity affected by the nature of the task?
2. How is the process of building intersubjectivity affected by the interaction style of the dyads?
3. Is it possible to recognize the development of intersubjectivity during the task?

### 2.2. Context and participants

This study was conducted in a Secondary State school, located in a main urban-risk centre in Brasilia, Brazil. The school serves approximately 3100 students and employs 185 teachers. In 2006, the platform Moodle (Modular Object-Oriented Distance Learning) was introduced to apply tests, exercises, and download materials. Since then, teachers have been using this platform. Eight students, (three girls and five boys, ages 17 to 18 years old), attending the third year of secondary education, accepted participation in this research. Therefore, we had four dyads: dyad 1 composed of Agnes<sup>1</sup> (female, age 18) and Deca (female, age 17); dyad 2 composed of Bella (female, age 18) and Tottein (male, age 17); dyad 3 composed of Snorlax (male, age 18) and Bakufun (male, age 18); dyad 4 composed of Rick (male, age 17) and Geo (male, age 17).

In their personal experience, these students were all very familiar with digital technology. They all started very young in using the Internet (around 8 years old) and they seemed to be very confident and positive about the use of it.

### 2.3. Tasks and procedure

Two different problem-solving tasks were designed. Even if both tasks could be considered to afford a problem-solving approach, they were different in nature. The first task required students to take a position about the use of technology in the classroom. Two reading materials were provided: a) one written by an American specialist claiming that teachers should allow the use of smartphones, tablets, and networks in class, with teachers preventatively learning how to manage such devices; b) the second, material presenting various opinions gathered by different voices and positions such as directors, coordinators, and teachers against the use of mobiles and tablets at school. This type of problem-solving fosters reasoning and comparison between different positions and strengthens the connection to a real situation that Brazilian students face every day at school. With this task, the focus is on the students' opinions and positions: whether to allow the use of digital devices in class. The following table shows the instruction given to the students to perform Task 1 (Table 1).

The second problem-solving task was based on projection into the future and perspective-taking. In this task, students were required to imagine "How would the school of the future be in 20 years". The dyads were directed to choose the perspective of one or more relevant figures and then discuss the problem from the figure's point of view. The following table contains the instruction given for Task 2 (Table 2).

A Philosophy teacher, a researcher, and a computer technician were briefed and primed to support the two tasks. After giving the

<sup>1</sup> These are pseudonyms used to preserve privacy.

**Table 1**  
Instructions for Task 1.

---

Dear Student,

The aim of this forum is to ask your opinion on two articles:

- ✓ Article 1 – Park School allows students to use mobile phones but only in optional classes.
- ✓ Article 2 – Expert opinions about the use of mobiles and tablets in the classroom.

Base your activity as follows:

1. The reporter Joanna Dale, after speaking with a number of teachers and students on the use of mobiles and notebooks at school, obtained a variety of opinion. What do you think about the students' views?
2. What answer would you give if you were in the place of the teachers, coordinator and the Head of School?
3. The expert Oge Marques comes to the defence of mobiles and tablets in class. What's your opinion about that?

\* Work with your peer and comment on your colleagues' posts if you want!

---

instructions to students, the teacher and the researcher left the lab, while the technician remained for technical support. The topic of the tasks was not discussed previously. The dyads were free to move in the lab, but they remained sitting in front of the computer all the time. They had at their disposal paper and pencil to take notes and they could freely navigate through the Internet. Students actually visited a few sites searching for information connected to the tasks. 40 minutes were allotted for each dyad and for each task. All the sessions were video-recorded, and the interactions were thoroughly transcribed.

#### 2.4. Corpus of data

The whole corpus of data consisted of the eight sessions' transcripts during which the four dyads of students worked on the two different problem-solving tasks. Table 3 reports the time spent on each task by each dyad.

The transcripts were segmented in units of analysis based on turn-taking because it ecologically captured the conversational context. We reached 1.374 units of analysis for Task A and 567 units for Task B. All units were coded according to a purpose-built codebook for content analysis.

#### 2.5. The codebook

The derivation of the codebook was designed within a dialogical, qualitative, and emic perspective (Pike, 1993). Through the codebook, it was possible to identify the main features of the intersubjective system emerging during the discursive processes (Hakkaraïnen & Sintonen, 2002). To reach the final version of the codebook, where five macro-categories were determined, three steps were followed according to the precepts of Grounded Theory (Corbin & Strauss, 1998).

In step one, three different researchers, all of them fully aware of the research aims, independently examined the longest transcription to produce a first draft of a codebook. As a result of this step, five macro-categories and a few sub-categories were roughly identified, based on the concepts discussed in the theoretical section above, such as the definition of space-time, how the dyads interacted, the need to define the activity, the role played by the tools dyad members were using, and individual positioning.

In the second step, the three researchers convened a meeting to discuss and seek consensus for this first set of categories. During this step, the macro- and sub-categories were better defined originating a new version of the codebook that was applied to all the transcripts. The outcomes were discussed with two additional researchers to validate the set of categories. Therefore, a total of five researchers contributed to the production of the codebook.

In the third and final step, the codebook was finalized. Definitive categories were inductively derived: they were "grounded" in each feature detected within each transcript, and conditions under which to assign a certain category were clarified. For example, when a student intervened by completing the sentence of their partner student, it was inferred that the student was following similar reasoning in agreement with their partner. This was labelled "Interstice". The final version of the codebook included five macro-categories and 21 sub-categories (see Table 4).

Five macro-categories– Space and/or time Definition, Levels of interaction, Defining the activity, Tools/objects, Voicing and positioning – emerged as capable of describing the intersubjective process within the dyads. Each sub-category was mutually exclusive so as to assign one category to each turn. The application of the codebook to the whole set of transcripts for content analysis was

**Table 2**  
Instructions for Task 2.

---

Dear Students,

The aim of this forum is to ask your opinion. Imagine the school of the future in 20 years. Choose one or more of the listed roles as a possible person with whom work for this task: the president, the Minister of Education, the Governor, the Head teacher, a teacher, a student, or another person at your choice.

Once you have selected a person, describe in detail how the school would be. You may use pictures, videos, illustrations, music, blogs, and information on the web-sites – anything you like from the Internet to build your ideas, and then post them here. Later you should explain what you would need to change learning and teaching.

\* Work with your peer and comment on your colleagues' posts if you want!

---

**Table 3**  
Time spent on each task.

	Task A	Task B
Dyad 1	61.08 min	15.20 min
Dyad 2	15.57 min	15.19 min
Dyad 3	25.30 min	13.58 min
Dyad 4	33.51 min	05.48 min
Total	136 min	50 min

discussed among the researcher group and, after three cycles of reviews, 100% of agreement was reached in the assignment of the sub-categories to the whole data set.

### 3. Results

The codebook was used to analyse each session with the following aims:

1. To understand the differences between the two tasks so as to answer the first research question (How is the process of building intersubjectivity affected by the nature of the task?). To this aim, we will compare the two types of tasks searching for differences between them;
2. To understand whether dyads have specific interactive profiles so as to answer the second research question (How is the process of building intersubjectivity affected by the interaction style of the dyads?). In this case, we will compare dyads and check whether their categories' distribution differs;
3. To understand whether there is a general category distribution. In this case, we will examine the four interactions, compare the sequence of categories, and check if there is a similar succession of specific categories across tasks. This will enable us to answer the third research question (Is it possible to recognize the development of intersubjectivity during the task?).

#### 3.1. Comparing the tasks

To better identify the peculiarities of the two tasks, we can look at the frequency distributions reported in Fig. 1.

As we can notice from this graph, both tasks record high frequencies of the first two macro-categories – Space and/or time definition and Levels of interaction – for all the four dyads. To have a more analytic understanding, we looked in detail at each sub-category for both tasks (see Figs. 2 and 3).

By looking at these graphs, we notice that -for both tasks- definition of space/time (macro-category 1) concerns the digital, physical and semiotic space. Voicing and positioning (macro-category 5) have a discursive nature that allows students to reciprocally appropriate each other's positions. We can conceive these two macro-categories as strictly depending on the blended nature of both tasks.

To the traditional “space of the problem”, a new layer is added, which is the digital space defined by the participants (see Excerpt n. 1), sometimes by pointing on the screen.

**Excerpt n. 1 (Dyad 3- Cat. 1.b).** Snorlax: Stop a minute! oh my God! This is Linux! [*Referring to the computer system*]  
Bakufun: I hate Linux. But let's enter and access the web anyhow.

The digital environment of an operational system is part of a multifaceted space where the problem-solving task must be accomplished. The physical setting is part of this multifaceted space and, as such, participants need to define it (see Excerpt n. 2).

**Excerpt n. 2 (Dyad 4. Cat. 1.a).** Rick (taking the keyboard): let's type the password  
Rick (then looking at the camera): one, two, three... start recording!

To accomplish the task, Rick needs to take the keyboard and look at the camera; he needs to define the dyad's actions in the physical space. The overall space within which they are going to work is defined. Furthermore, a semiotic definition of the space is added (see Excerpt n. 3).

**Excerpt n. 3 (Dyad 1. Cat. 1.c).** Agnes: you won't need paper for these things. Did you get that? Also for the school test, right? If we use laptops, we will not do tests at school.

The definition of the task space passes through means that are not concretely there but are evoked, such as remote school tests without paper and with laptops.

The digital public space, where the two members of the pair are requested to agree upon what to write, impacts the macro-category of voicing and positioning (see Excerpt n. 4).

**Excerpt n. 4 (Dyad 3. Cat. 5.d).** Bakufun: Yeah, it's true... social networks can help us to exchange more information and knowledge but, as a whole, it has advantages and disadvantages.

Snorlax: You need to know how to use it [...]. If you ask for information about any activity to another student, that would be an advantage! But we all know that mobile wouldn't be used in this way. Students would simply chat about something that is not related to

**Table 4**  
The codebook.

Macro-categories	Categories	Examples
1: Space and/or time definition	<p>1.a Physical. Reference to share objects; define the physical space</p> <p>1.b Digital. Definition of digital space (to point on the laptop screen to define a location on platform: here, this, that, there, first, after, underneath etc.)</p> <p>1.c Semiotic. References to tools not concretely there, semantically evoked.</p>	<p>Students refer at the same material. A student closes the door so as to delimit the working space Agnes: <i>I think we put it here, on the topic, right?</i></p> <p>Agnes: <i>For example, if you need a laptop in class, and all the students have a laptop, you should use these technologies just to visit web-sites; and you can write your observations on the notepad, or other such things.</i> Deca: <i>Besides this, if you access e-books, for example, you don't need to bring books every day to school.</i> Silent individual reading Agnes: <i>No. I disagree!</i> Deca: <i>No!</i> Agnes: <i>We disagree! Do we disagree?</i></p> <p>Agnes: <i>Because they cannot resist...</i> Deca: <i>...The seduction of social networks and other things.</i> Deca: <i>There is a mistake here. Get the keyboard and put "and this makes the student lose contact with the teacher."</i></p> <p>Deca: <i>Oh, everybody posted. So, we can answer.</i></p>
2: Levels of interaction	<p>2.a Individual work.</p> <p>2.b Synchronicity within the dyad. Comparison between individual work/thinking. Engage or open a conversation through which the individual thinking is disclosed to the partner and assumed as similar or different.</p> <p>2.c Interstice. Turn-taking completing each other's intervention.</p> <p>2.d Work in pairs. One invites the other to start or complete the activity. For instance, one dictates, and the other types; one reads while the other listens.</p> <p>2.e Community synchronicity. Attempt to synchronize with the larger group online.</p>	<p>Agnes: <i>Well, we do not need grades in Philosophy. Do you need them?</i> Deca: <i>No.</i> Agnes: <i>Because, if we are missing a lesson...</i> Agnes: <i>Yes, but she asked what we think about his position. Did you understand? About the use of devices, tablets and mobile phones in class.</i> Deca: <i>We write our opinion. We consider the expert is right in this moment.</i> Agnes: <i>I thought, when we read this for the first time, that (Brazilian) students are a bit immature by taking pictures of the teacher using mobiles phone only for joking.</i> Agnes: <i>Something like that... in the future students can work and use technologies in a specific area or use in their profession. It will develop the country.</i> Agnes: <i>Yeah, is Ctrl? Command Ctrl+C. Paste it using Command.</i></p>
3: Defining the activity	<p>3.a The value of the task. Reasoning around how much of what they are doing is valuable.</p> <p>3.b Interpretation of the tasks. Negotiation of meaning about the task.</p> <p>3.c Definition of what to do. Here the task is definitively interpreted and they take action.</p> <p>3.d Anchoring to the material. Clear reference to the material or the instruction given for the task.</p> <p>3.e Future perspective. Projecting the outcomes for their activity in the future.</p>	<p>Deca: <i>You should open a new window on Moodle.</i></p> <p>Deca: <i>Do we really need to do this? What we said is already filmed; we don't need to do it again.</i> Agnes: <i>Immature. Can I write that?</i> Deca: <i>Yes. But before, put a dot.</i> Agnes: <i>A dot?</i> Deca: <i>A dot or a comma? Wait, we have to think how to continue this sentence.</i> Agnes: <i>Yeah, Brazilian students are not prepared to use it. They don't know how to use it... to allow. They didn't have discipline in Brazil to use mobiles, tablets.</i> Deca: <i>They need discipline.</i> Deca: <i>Yeah. We should decide what the teachers would say. Teacher can accept technologies in class, but too limited.</i> Agnes: <i>We? Oh, it's sound weird.</i> Agnes: <i>He lives in the United States, right (the American specialist cited). There, he uses this kind of thing. But, it is a question of discipline. Because, they use it for the right thing, the right goal, isn't it?</i> Deca: <i>Yeah, they know how to use it.</i> Deca: <i>Students and teachers can suggest some propositions, and send them to the Minister of Education, and he should take it to the President. If the President accepts the proposal, he will give directions to the Minister and he will apply them. Don't you think?</i></p>
4: Tools/objects	<p>4.a Instrumental use. The focus is on understanding how the tool/object works.</p> <p>4.b "To think about". The focus is on what can be done with the tool/object.</p> <p>4.c "To think with". The action is relegated to the tool.</p> <p>4.d Boundary between tool and thinking. Actions where the technical focus is indistinguishable from the semiotic one.</p>	
5: Voicing and positioning	<p>5.a Exotopy position. Visualize the problem from a "Third position" (as viewer). For instance, they refer to Brazilian students in general, without including themselves.</p> <p>5.b Appropriation of voices. Attempt to voice parents, teachers, other students, politicians etc. They refer what they think others would or should say.</p> <p>5.c Reciprocal appropriation of the position. Others' positions are reported and justified.</p> <p>5.d Discursive position. The position taken about the problem is built discursively and it results in a combination of various points of view</p>	

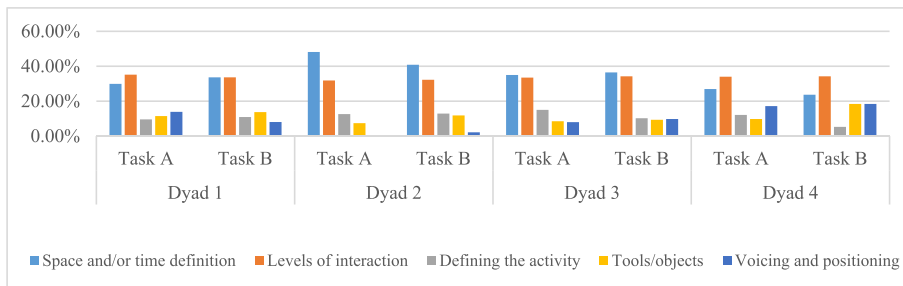


Fig. 1. Comparison of the five macro-categories across tasks and dyads.

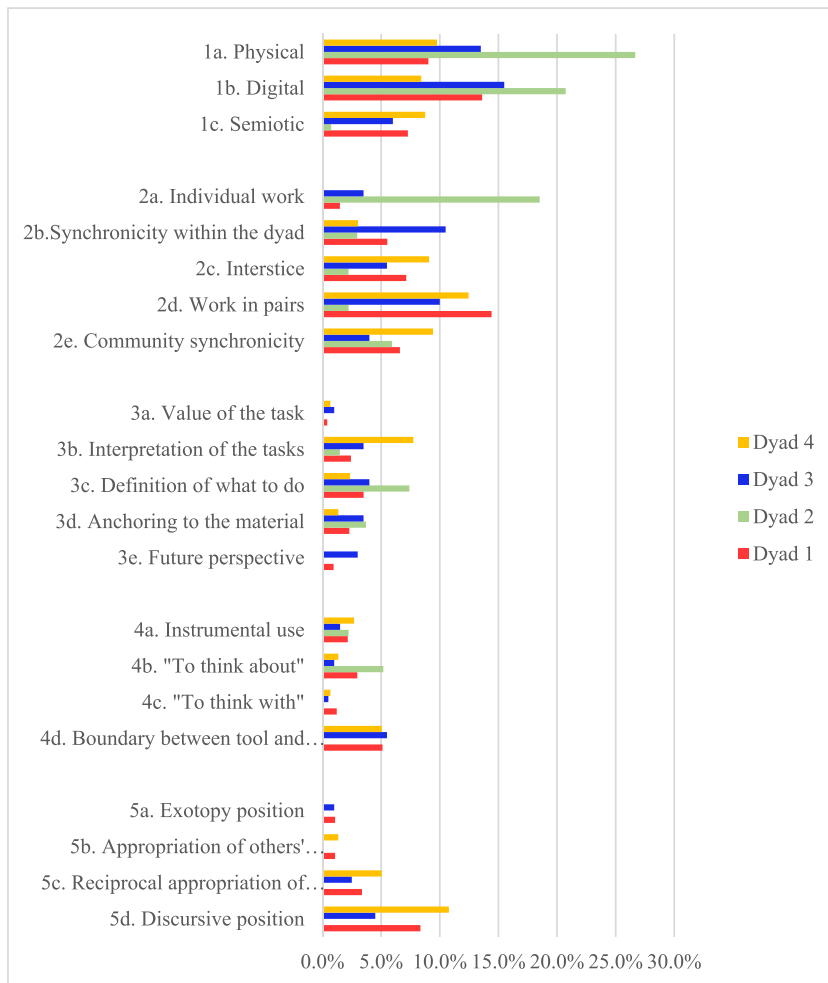


Fig. 2. Frequency distributions in Task A.

the subject.

In this excerpt, we see Bakufun expressing his personal position while Snorlax reports the position of “students” in general.

The public discussion in the digital space forces students -in both tasks- to express their opinion in order to check the degree of overlap or find ways to overcome the differences. Nevertheless, the two tasks differ when looking at Levels of interaction (macro-category 2), Definition of the activity (macro-category 3) and Tools/objects (macro-category 4).

The Levels of interaction, in both tasks, are generally based upon the sub-categories Work in pair (2.d), Interstice (2.c) and Individual work (2.a); but they differ in triggering the sub-categories of Synchronicity within the dyad (2.b) and Community synchronicity (2.e). In other words, interaction is generally based upon complementary work in pair, balanced turn-taking demonstrating



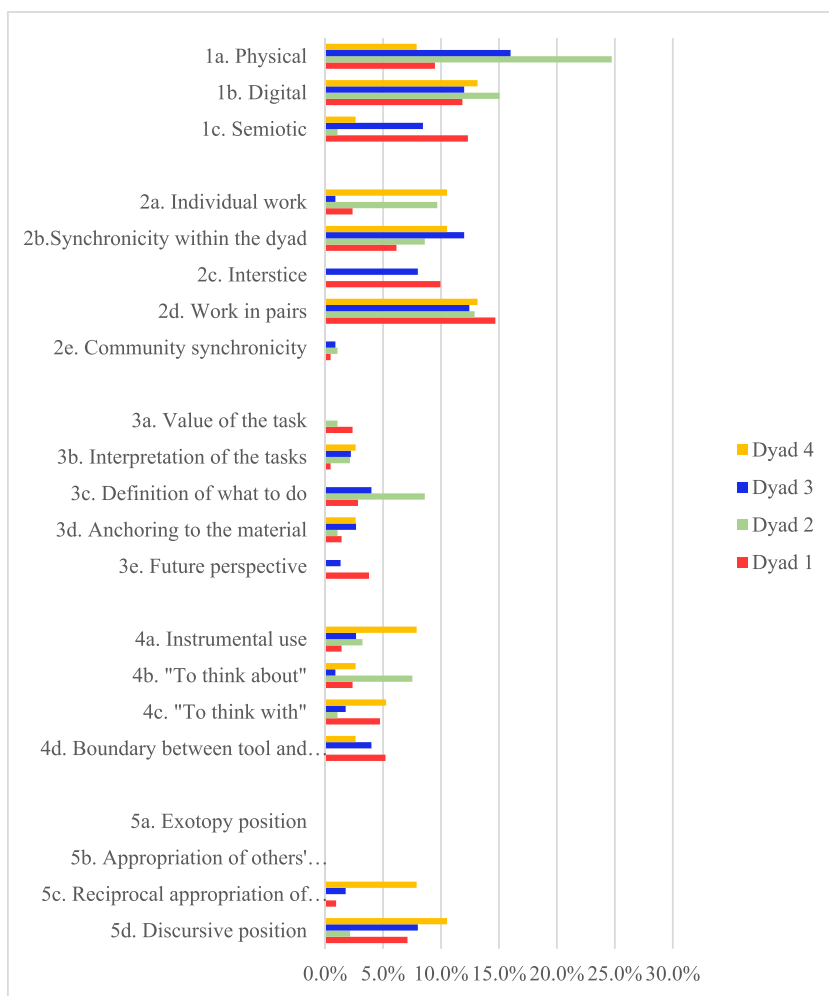


Fig. 3. Frequency distributions in Task B.

distributed thinking (interstice), and even silent individual work.

In both tasks the common point of departure for interaction is the category “work in pair”. The dyads perform actions according to a complementary pattern: one member types at the keyboard and the other one dictates words and checks what is written on the screen; one member looks for an issue in the text and the other one adds some details; one member doesn’t understand a point of view and the other one explains it by agreeing or disagreeing with it (see Excerpt n. 5).

**Excerpt n. 5 (Dyad 4. Cat. 2.d).** Geo: I did not understand!

Rick: I agree with that! You did not get it? I will explain you.

When interaction evolves, the work in pair follows different paths in the two tasks. In Task B, the higher frequency of Synchronicity within the dyad (2.b) shows an interaction becoming a comparison between individuals, that could lead toward an attunement to the other one’s position or to a clear contrast between the two members of the dyads (see Excerpt n. 6).

**Excerpt n. 6 (Dyad 1. Task B Cat. 2.b).** Deca: Well, the school... look here. Do you agree?

Agnes: Oh, maybe the school could provide other things.

Deca: Activities? What else? Let me see...

Agnes: Yeah, there will be more positive benefits with devices, such as scientific meetings or things that arouse interest.

In this case, Deca opens a space of confrontation with Agnes about technological devices at school, Agnes accepts and elicits a reflection that Deca is attempting to develop, and the final attunement between the two members is marked by “Yeah” in Agnes’ statement about the positive use of technology at school.

In Task A, there is also more Community synchronicity (2.e) that allows the interaction to widen the comparison to the online larger group, leading toward an identification with the whole community (see Excerpt n. 7).

**Excerpt n. 7 (Dyad 1. Task A Cat. 2.e).** Deca: Who posted this? Do we have to read? Scroll up, let's see the posts of these girls, by Annie, Rapha, and Vick.

Agnes: Do we have to answer their posts?

Deca: Yes, they posted it and we have to write a reply. This is not the question.

Deca reads one post: "The school should review its rules on the use of technology in class because of its wide restrictions. The students cannot solve their doubts by using their own mobiles. Also, they cannot take pictures of the board when the class is over. So these restrictions make students use them in an inappropriate way".

Deca: Yeah, students will do that.

In the attempt to synchronize their contribution to the extended community using the forum, Deca and Agnes widen the confrontation space considering what the other students already posted. They mark by "Yeah" their adherence to one of the published notes, they assimilate their position to that of the online group and recognize themselves in it. Tuning with the enlarged community leads them to identify themselves as an integrated part of it. It is interesting to note that community synchronicity leads the members to identify themselves even by contrast: they enlarge the comparison to the online group and differentiate themselves from the community position in a framework of mutual recognition. In this case, tuning with the enlarged group, leads them to identify themselves as a differentiated part of it.

Dyads are also busy with the Definition of what to do (3.c) in both tasks, showing their concerns for understanding and implementing what is required by the tasks. When performing Task A, the Interpretation of the task (3.b) and the Anchoring to the material (3.d) also receive high frequencies.

Finally, the sub-categories Think about (4.b) and Boundary between tool and thinking (4.d) have a similar pattern in both tasks. To think about tools/objects means to emphasize what can be done with them and to use them as a boundary between tool and thinking. In task B, the object is enriched by the Instrumental use (4.a), that focuses on the way the tool works, and by the To think with (4.c) category.

In synthesis, for both tasks, participants need to define: a) the borders of physical, digital and semiotic space; b) the activity through the functionality of the tools; c) their position in the discursive plot; and d) the relevance of the virtual community they are entering. The first two are instrumental actions aimed at performing the problem-solving task, but they are interlaced to the other two that are relational actions aimed at building their personal positions and their relationship with others. Particularly in Task A, participants widen their activity from what to do to a general sense-making process; then, they widen their interaction from the dyadic work to the reference to the larger community through a relationship of comparison leading to identification with the other members of the larger community. This widening of activity and interaction in a distributed framework (Annese & Traetta, 2012) is due to the connection of the task with a contemporary and well-known situation. This allows participants to feel competent and at ease to report their ideas online, to negotiate meanings, and to enter the online community. They widen instrumental and relational activities and, consequently, they extend the intersubjective process that acquires a blended nature. On the contrary, in Task B, dyads focus their instrumental activities on the centrality of the tool that becomes itself an action when they "think with" "tools/objects" and their relational activities on the dyadic work that produces a great confrontation within the pair. As already said, this confrontation can lead to an attunement or to a clear contrast between the two members, producing a strong identification respectively by assimilation or contrast within the dyad. This narrowing of activity and interaction in a dyadic framework is probably caused by the nature of the task based on a future and unknown situation, where participants may feel less competent and aware. In this task, the two members negotiate what they do together and they appropriate each other's thoughts by building an intersubjective framework connected mainly to the dyad itself. Even a reduced space of social comparison (within pair) becomes an intersubjective space for positioning Self

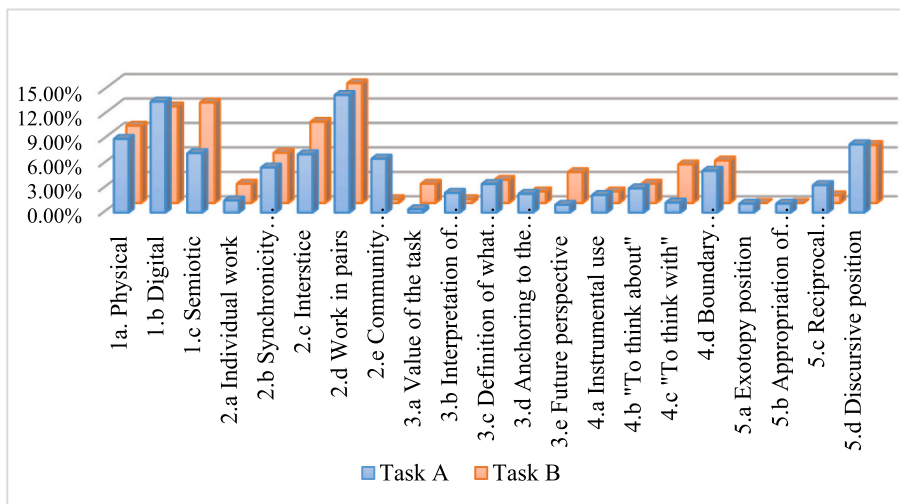


Fig. 4. Categories' distribution in Dyad 1.

and Other.

### 3.2. Comparing the dyads

To better understand the differences between the dyads, we will examine the frequency distributions (see Figs. 4, 5, 6 and 7) and define what we call the dyad's profile, determined by the specific category distribution of each dyad.

The distribution of categories in the four dyads shows similarities and differences. For all of them, the most frequent macro-categories are Space/time Definition and the Levels of interaction. Each dyad emphasizes physical (1.a), digital (1.b) and semiotic (1.c) definition of the space or time, as they need to outline the physical space, to show on the screen the digital space and to evoke symbolically objects that are not there – with the only exception of dyad 2 that did not resort to semiotic representation of the space/time.

About the Levels of interaction, the work performed in pair (2.d) seems to have a central role for each dyad. Dyad 1 and dyad 3 are characterized also by a relevant frequency of Interstice (2.c), where the conversational integration allows a sort of dialogic thinking where each component rephrases and concludes the sentence of the interlocutor.

Interstice is more than a simple turn-taking completing the sentence uttered by the other member; it implies a social organization of the conversational interaction. This social organization dialogically frames a sort of distributed thinking between the two members of the dyad (see Excerpt n. 8).

**Excerpt n. 8 (Dyad 3. Cat. 2.c).** Snorlax: Let's choose...

Bakufun: head-teacher, teacher, student, and Minister of Education.

Snorlax: Four?

Bakufun: Yes. Four people.

Snorlax: I agree. The school of the future...

Bakufun: The school of the future would have the ability to make the student succeed.

In this excerpt, Snorlax and Bakufun are dealing with four school roles and suddenly they talk about “school of the future”. This may appear as an illogic jump outside the pair, but inside the pair Bakufun seems to perfectly follow Snorlax's thinking; in fact, he promptly completes Snorlax's sentence. Actually, the illogic jump is a mechanism regulating the implicit during the conversation. Bakufun and Snorlax seem to be able to understand this mechanism. We infer this based on utterances as “I agree” and by completing each other sentences (“The should of the future would have....”). This generates a distributed thinking within the dyads. Their thoughts are progressively built based on the dialogical scheme of the interstice.

The dyads are featured also by Synchronicity within the dyad (2.b) which may lead to an alignment of positions after a reciprocal comparison. The interaction profile is based on work in pairs, interstice, and synchronicity within the dyad; therefore, attention to the peer with whom they are working is allotted, fully recognizing the importance of the peer.

On the contrary, dyad 2 and dyad 4 are featured by Individual work (2.a) as a starting point for the Synchronicity within the dyad (2.b), leading to a comparison between individual work and thinking. For these pairs, is important to start working and thinking alone (see Excerpt n. 9), moving to work in pair only later.

**Excerpt n. 9 (Dyad 2. Cat 2.a).** Bella and Tottein are looking at the screen and reading in silence.

Bella: I think I had...

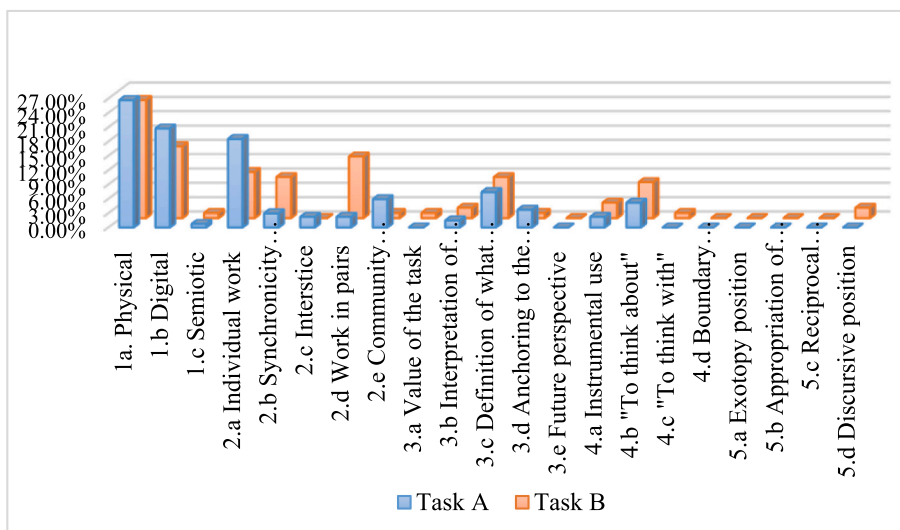


Fig. 5. Categories' distribution in Dyad 2.

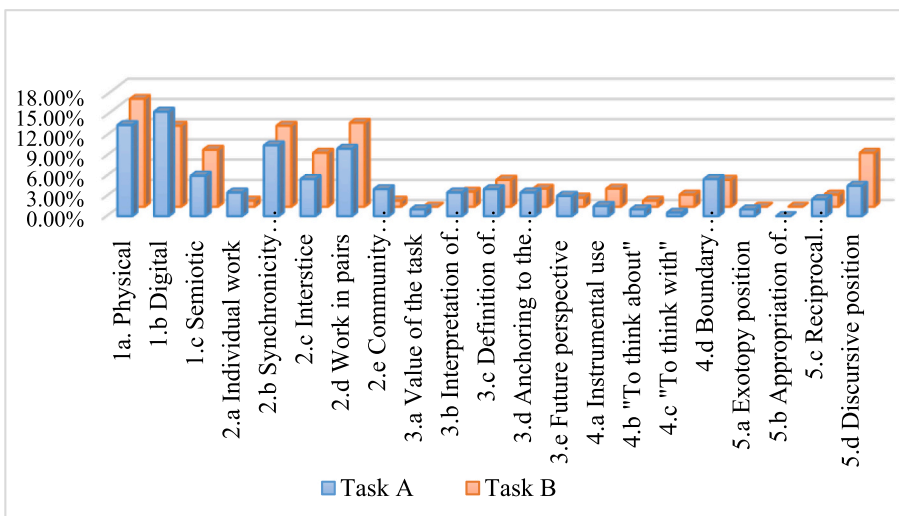


Fig. 6. Categories' distribution in Dyad 3.

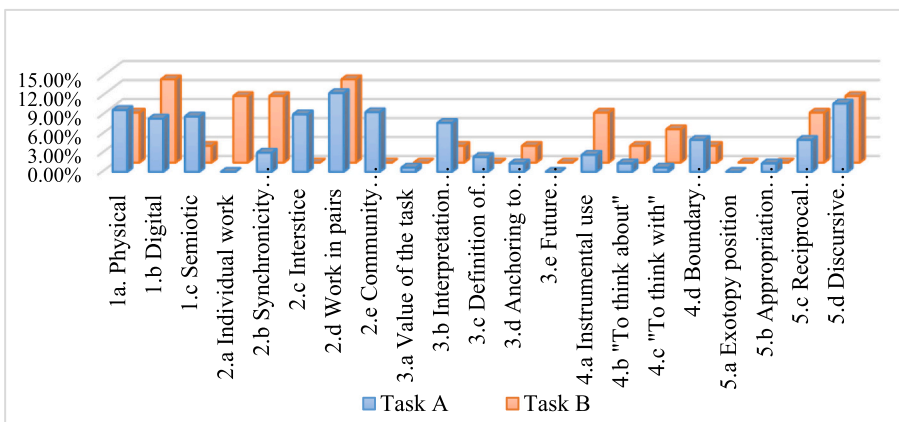


Fig. 7. Categories' distribution in Dyad 4.

Tottein: I don't think so. I'm sure this is the most relevant message of all and it's already written. Here, see it, ahm! Do you have another opinion?

In this situation, Bella tries to share her opinion, but Tottein sharply interrupts her by maintaining that the message they are reading is the only significant one. The closing rhetorical question could have a double effect: silencing Bella and pushing her to go back to individual reading or making Bella reply by stating her opinion to arrive to a comparison within the dyad. This profile is based on work in pairs, individual work, and synchronicity within the dyad and the individual work functions as the starting point.

The core category for all the dyads is the definition of what to do (3.c). Additionally, dyad 2 and dyad 3 anchor their work to the material (3.d) to connect the action to the information they received for the task. Dyad 1 and dyad 3 resort to the future perspective (3.e) and only dyad 4 shows some interest in the task interpretation (3.b).

Concerning the Tools/objects, each dyad has a specific layout although it is possible to recognize some patterns: Objects at the boundary between tool and thinking (4.d) is a frequent category, followed by the need to think about the tool (4.b), to understand its instrumental use (4.a), and, less frequently, to think with the tool (4.c).

Finally, Voicing and positioning shows a similar trend for all the dyads. Discursive position (5.d) is essential as it is built in interaction with others' positions, through the reciprocal appropriation (5.c).

In synthesis, all the dyads define their space/time of interaction in physical, digital, and semiotic terms. Dyads 1 and 3, through the reciprocal reformulation and integration of activities (Interstice), focused their interaction on their complementary work and distributed thinking. Dyads 2 and 4, through silent and separated work (Individual work), focused their interaction on less shared work and independent thinking. The former two dyads concentrate their work on interdependent and social dimensions by a mutual confrontation, whereas the latter two dyads need an individual starting point before sharing activities and points of view.

For all the dyads, the transformation of the task in action is characterized by what to do, how to employ the available instructions, and how to make sense of the task. This sense-making process is made through the tools, and it is strictly connected to students' ability to understand each other. Participants make sense of what they do through instrumental activities and share personal positions through their relational activities. This overall sense-making process indicates a dialogical scheme that is the real framework of intersubjectivity. Despite the differences, all dyads build an intersubjective framework within which they negotiate the meaning of the task, taking into account each other's thinking and anticipating goal-directed activities. As Rommetveit (1979) maintained, this sense-making process also concerns the way participants position themselves—the representation of Self and Other in the discursive construction of the intersubjective space (Annese & Traetta, 2018).

Once the dyad profiles are sketched, we wondered if it was possible to outline a consistent path through the categories, if they could be organized into a sequential succession. We examine this point in the next paragraph.

### 3.3. The sequence of building intersubjectivity

We look now at the sequence of categories, regardless of dyads and task specificity, to understand whether there is a path along which intersubjectivity is built and maintained. We found that typically the interaction started with an initial inspection of the material and of the instruction provided (Cat. 2.a). This activity may last a few minutes and often is done in silence (just reading individually) or with only a few sentences exchanged.

Right after, we could trace a second step: students started questioning each other about what to do. This step – that lasted from 5 to 10 min- could be aimed at seeking to determine: (a) what actions to take (cat. 3.c), (b) the physical and digital space of the task (cat. 1), and (c) an understanding of the value of task and actions (3.a). The excerpt below (see Table 5) illustrates how this phase was performed by dyad 1.

In this excerpt, we see that the girls worked individually, and at the same time, they seemed to trace the borders of the joint-working space – both physically and digitally. The nonverbal movements - changing synchronously, as in a mirror, the position of their arms – suggest an attempt of a silent tuning.

A third phase is featured by the effort to define how to perform the task. Participants checked on each other about what they understood of the task (cat. 3.b) and they discussed the meaning of each tool available (cat. 4.a). At this stage, it can be observed that a shift took place from instrumental use – for instance wondering about the commands on the keyboard – to the conceptual use of the tools. During this phase, the students considered what they already know (cat. 2.b), recognizing the value of the extended community (cat. 2.e). To simplify the presentation, we extract the representative example of this phase from the same dyad (see Table 6).

A fourth phase could be defined as an attempt to finalize and accomplish the task. During this phase, the dyads: (a) may go back to the material concerning the task (cat. 3.d), (b) take positions about what to do (cat. 3.c), and (c) possibly take up voices coming from the material, the forum (other students' notes), from their personal experiences or from the society and culture at large (all category 5). Positions and voices are intertwined and confronted. This phase lasts around 5 to 10 min.

In the final step, the dyads may check what they did; in some cases, they emphasize what they agreed upon (cat 2.b) or they discuss what they did when divergent personal positions appeared (cat. 4.c).

## 4. Discussion and conclusions

In this study, we wondered whether intersubjectivity may depend on the design of the task (situated in the current classroom context versus projected into the future) and/or on the dyad specific profile; we also sought to understand how the process of building intersubjectivity develops during the task. Our results provide evidence that both the task and the dyads impact the intersubjective processes.

Task A— strictly related to a real situation students face every day in the classroom—triggered higher frequencies of all the categories (1.374 units of analysis in total versus 567 in task B). This may lead to the conclusion that familiar tasks can produce richer intersubjective processes. Nevertheless, there was a systematic difference in the interaction style for each dyad. For instance, Dyad 1 was consistently more productive, with a higher pick in Task A. This may suggest that each specific dyad interaction may generate peculiar intersubjective processes in the adaptation to the specific task.

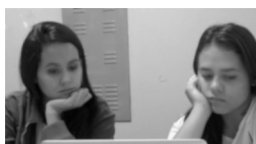
Even if all dyads felt the need to define the physical, digital, and semiotic space of work, they approached the task in different ways. Two dyads (1 and 3) focused from the outset on the social dimension seeking a mutual comparison, while the other two dyads (2 and 4) preferred an individual starting point. The former two dyads concentrated intersubjective processes in the interdependent and distributed work; the latter two dyads preferred independent and less shared work. The latter ones showed a clear increase in intersubjective activity only after having 'broken the ice', so they had a longer latency in defining intersubjective rules. These results lead us to consider how flexible participants can be in adapting the processes to the task and to the other in building the intersubjective plot. These open and dynamic processes, continuously adapting to situation-related aspects, such as the type of task or the interaction style, shape the intersubjective space and confirm that intersubjectivity is context-sensitive and ever-changing (Rommetveit, 1979). Even if the intersubjective framework seems to be defined, it is a pliable construction that can be unceasingly remodelled depending on the flow of the interaction (Morganti, Carassa, & Riva, 2008).

Nevertheless, a five-step process could be found as common to the dyads and across both tasks. The steps are:

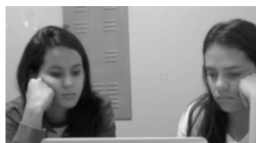
1. initial inspection of the material and the task;
2. definition of the task, its physical and digital space, and its value;

**Table 5**  
Step 2: Defining the task.

Nickname	Time	Utterances	Context	Sub-category
Deca	01:34	<i>The question is about Ogge Marques' reporter and this text, right?</i>	They read some notes in the forum and the instruction about the task.	Defining the task
Agnes	01:35	<i>Yes.</i>	Philosophy teacher allows Agnes and Deca to be out of the class to participate to the task. Agnes seems to be nervous about missing class.	Attempt to define the value of the activity.
Agnes	01:45	<i>Well, we do not need grades in Philosophy. Do you need ((grades))?</i>		
Deca	01:46	<i>No.</i>	Deca glances to the door and right after Agnes closes it.	Defining the physical space.
Agnes	01:46	<i>Because, if we lose a lesson..</i>		
Deca and Agnes	02:21 to 03:11	They are reading in silence.		
Deca and Agnes	03:12	<i>Can I go down a bit?</i>	Agnes controls the mouse. She is actually asking whether she can scroll down the screen.	Defining the digital space.
Deca	03:12	<i>Um, um.</i>	They are reading the notes posted by their peers on the forum. Agnes is typing and moving the mouse. Agnes looks at Deca and asks where she is reading, Deca lifts her hand and indicates the point where she is reading.	Defining the digital space
Agnes	03:13	<i>Where are you ((reading))?</i>		
Deca	03:13	<i>Where ...</i>		
Agnes	04:22	<i>Can I go down a bit?</i>		
Deca	04:22	<i>Um, um</i>		
Agnes	04:48	<i>Can I?</i>		
Deca	05:00	<i>Um, um</i>		
Agnes	07:58	<i>Can I?</i>		
Deca	07:59	<i>Um, um</i>		
Deca and Agnes	08:00 to 08:25	They are reading in silence	They keep in silence, reading. They even maintain specular positions (see their arms).	Synchronicity within the dyad.



They change the position at the same time



3. definition of how to perform the task and reflection on the role of the tools available; sometimes references to the digital community can appear;
4. finalization of the task during which positions and voices usually emerge; and
5. wrap up of what has been done, aimed at making sure dyad members both agree on the end results; at this stage, some personal positions may appear.

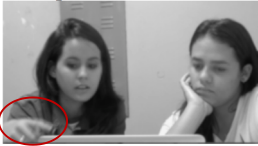
Comparing what was found by Stahl (2016) in a group condition, we did not observe the emergence of different proposals or the subsequent process of negotiating between those proposals. Working in dyads reduced the number of proposals, but allowed more space for voicing and positioning. Furthermore, the role covered by the technology seems to be more articulated, because participants need to define: (a) the borders of the digital space; (b) how relevant is the virtual community they are entering; and, (c) the relevance and functionality of each tool.

All together, these results show that intersubjectivity is a process in which multiple layers can be observed. The codebook derived for this investigation could be a useful tool to detect the elements of such complex processes in a situation where dyads work on a blended problem-solving task about issues similar to those herein described.

It is important to note that there are limitations inherent in the design of this investigation, such as the limited sample and the specific cultural context of this study. Nevertheless, we believe this study can contribute to the understanding of how intersubjectivity unfolds in blended problem-solving tasks. The five macro-categories derived from the inductive process of grounded theory—specifically, space and time definition, levels of interactions, definition of the activities performed, how the tools/objects are perceived, and the voicing and positioning of participants – functioned as effective components capable of revealing the intersubjective plot in problem-solving tasks performed in the dyads. These categories raised from participants' verbal and physical actions; thus, their

**Table 6**

Step 3: Defining how to perform the task.

Nickname	Time	Utterances	Context	Sub-category
Deca	08:26	<i>Do we have to respond these questions, don't we?</i>	Deca points to the monitor.	Defining the task
				
Deca	10:08	<i>Oh, everybody posted. So, we can answer. Maybe one? One or two notes?</i>	They refer to the notes others students already posted in the forum.	Community synchronicity
Deca	13:41	<i>Immature. You can write immature.</i>	Deca is suggesting to Agnes what to write.	Work in pair
Agnes	13:43	<i>Immature. Can I put it?</i>	Agnes is making sure they agree on what to do.	Reciprocal appropriation of the position
Deca	13:43	<i>Um, um. Before, put a dot.</i>	The dot is here functioning as a boundary object between formal aspects of grammar and thinking activity.	Boundary between tool and thinking.
Agnes	13:48	<i>Dot?</i>		
Deca	13:49	<i>Dot and comma. Wait, we have to think how to continue this sentence.</i>		
Agnes	13:52	<i>No, maybe put a comma. Hang on! Because, this is about their relation with technology. For the use of technology they are immature.</i>		

veracity are valuable assets in understanding the intersubjective process. The categories we outlined are not always clearly discussed in the existing literature; therefore, more research is needed to better understand how they function, whether they are unique to the dyadic conditions of problem solving used in this investigation, and to determine whether the sociocultural nature of the participants may have been responsible for their appearance.

Our study may also have practical implications, particularly useful in blended situations. It may help teachers and instructors acknowledge that intersubjectivity is a key factor for collaborative learning activities. Consequently, teachers might attempt to map how the dimensions we outlined appear in their context. This would allow, for instance, a better recognition of the relevance of the physical space even when the task is performed online. Similarly, an adequate amount of time should be allotted for making sense of the task, the material and the available information. Another important lesson we learnt is that it is also important to try to engage students in the task from the outset. Teachers should support sense-making of the task, reconciling it with the general context and the local situation.

We interpreted disagreements, oppositions, coalitions, and opposing positions in both tasks as essential for the intersubjective dynamics, since they enabled the participants' argumentative and critical capacity (Freundlieb, Hudson, & Rundell, 2004). In the discursive interplay positions, such as the exotopic one, the appropriation of other voices, the reciprocal appropriation of positions and the discursive positions, function as mediators of the meaning production (Beraldo, 2018) and are crucial for the awareness of the Self and the Other in the discourse (Annese & Traetta, 2018; Glaveanu, 2019). Teachers and educators could extract pedagogical directions from these elements to sustain intersubjectivity when proposing collaborative problem-solving tasks in blended contexts (Biesta, 1999; Murphy & Brown, 2012).

Finally, it would be extremely interesting if our research design and the codebook would be replicated in other countries and at different school levels, as well as with different types of problem-solving tasks. We also hope that the results will be beneficial for the upcoming post-pandemic evolution, since blended solutions are likely to be more widely adopted at many educational levels.

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