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The Distributed Educational Influence Model:
A Conceptual and Methodological Tool for the Analysis of Collaborative Learning Processes in Digital Environments

El modelo de Influencia Educativa Distribuida
Una herramienta conceptual y metodológica para el análisis de los procesos de aprendizaje colaborativo en entornos digitales

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Abstract
The concept of educational influence, developed within the framework of a series of studies analysing educational practices in face-to-face contexts, refers to the interpsychological processes through which teachers — or other educational practitioners present in the learning context — help students to construct progressively richer, more complex and more valid meanings regarding the contents of teaching and learning. If the educational influence exercised by the teacher or other practitioners is to be effective, it must be contingent and adapted to the learning process as it evolves. The concept of distributed educational influence reflects the idea that in collaborative learning settings the exercise of educational influence is distributed among all participants, since all can and should contribute through their actions to the achievement of effective collaboration that promotes the communicative, social and cognitive processes involved in learning. In this paper we present a theoretical and methodological model for analysing collaborative learning processes in digital environments based on the concepts of educational influence and distributed educational influence. We also describe the results of research aimed at refining some of the model's components and exploring some of its practical implications.

Keywords: Collaborative learning in digital environments, content analysis, distributed educational influence, educational influence, structural analysis

Resumen
El concepto de influencia educativa (IE), elaborado en el marco de una serie de trabajos sobre el análisis de las prácticas educativas en contextos presenciales, hace referencia a los procesos interpsicológicos mediante los cuales los profesores, y en su caso otros agentes educativos, ayudan a los estudiantes a construir significados progresivamente más ricos, complejos y válidos sobre los contenidos de enseñanza y aprendizaje. Para que la IE ejercida por el profesor o los otros actores sea eficaz debe ser contingente y ajustarse al desarrollo y evolución del proceso de aprendizaje. El concepto de influencia educativa distribuida (IED), por su parte, refleja la idea de que en las situaciones de aprendizaje colaborativo el ejercicio de la IE se distribuye entre todos los participantes, ya que todos pueden y deben contribuir con sus actuaciones a conseguir una colaboración eficaz que promueva los procesos comunicativos, sociales y cognitivos implicados en el aprendizaje. El trabajo presenta un modelo teórico y metodológico de análisis de los procesos de aprendizaje colaborativo en entornos digitales basado en los conceptos de IE e IED y describe los resultados de algunas investigaciones orientadas profundizar en algunos de sus componentes y a explorar algunas de sus implicaciones prácticas.

Palabras clave
análisis estructural, análisis de contenido, aprendizaje colaborativo en entornos digitales, Influencia educativa, influencia educativa distribuida

1. Background: The exercise of educational influence and the analysis of teaching and learning processes

The model of distributed educational influence has its roots in a series of studies, beginning in the 1980s, that sought to analyse the educational practices of schools and families (Coll, 1981; Coll, Colomina, Onrubia, & Rochera, 1992; Colomina, 2001; Mayordomo, 2003; Onrubia, 1992; Rochera, 1997; Segués, 2006) from a constructivist perspective on teaching and learning (Coll, 1990, 1999). The purpose of the concept of educational influence — from which distributed educational influence, the concept of interest here, derives — was to explain and help to understand school-based learning as a process of knowledge construction in classroom contexts. In such settings, face-to-face interaction and direct communication between all those involved play a key role, and hence it is to these contexts that the concept of educational influence primarily refers.

1.1. Guided knowledge construction and educational influence in face-to-face contexts

The sociocultural and constructivist perspective on teaching and learning that was employed in these studies regards classroom learning as the process whereby students construct and attribute meanings in relation to a body of cultural knowledge that has been incorporated into the school curriculum as learning content. Furthermore, it is considered that a key driver of this process is the mediation and support provided by the teacher, whose job it is to encourage, advise and guide students towards these culturally constructed and accepted meanings. From this perspective, learning is the result of a process that is simultaneously cultural, social and individual: cultural because the learning contents reflect historically constructed and culturally organized knowledge; social because the process and its outcomes depend to a large extent on the support, advice and guidance of an educational practitioner who acts as a mediator between students and the learning contents; and individual because students are ultimately responsible for their own learning, and nobody else can perform this task for them.

In accordance with this view, the individual (internal) construction of meanings that characterizes learning and its social (external) orientation are regarded not as being in opposition but as two aspects that are necessarily and intrinsically interrelated. Hence, educational influence is conceptualized as an 'aid' to the process of construction: it is an aid because this process is inherently internal and individual, and it cannot be replaced or fully determined from without; however, it is a necessary aid because without it, it is highly unlikely that the student who engages in construction will be able to fully appropriate the meanings of the cultural contents whose learning constitutes the goal of school-based education.

Educational influence refers to the interpsychological processes through which teachers or other educational practitioners help students to construct progressively richer, more complex and more valid meanings regarding situations, phenomena, or physical or symbolic objects. If it is to achieve its goal and be effective, the help provided must be adapted to the process of construction that students are engaged in, and as such it will vary in both nature and degree depending on what this process

entails. This means that it may take different forms and be offered in different ways through a variety of teaching interventions or strategies. Within this explanatory framework, processes of educational influence constitute the link between the individual and internal domain of learning (i.e. the student's own construction and attribution of meanings to the learning contents) and its more cultural and social aspects (i.e. the appropriation and reconstruction of existing cultural knowledge with the help of teachers).

From the perspective adopted by the aforementioned studies there are both theoretical and practical reasons why investigating processes of educational influence and identifying and analysing the mechanisms through which such influence is exercised (i.e. how and when do teachers achieve effective educational influence) is a topic of particular interest. From the theoretical point of view, processes of educational influence are a core component of the explanatory model proposed by constructivist accounts of teaching and learning, insofar as they are what connects students' learning to teaching, where the latter refers to all those actions which aid or support the learning process. From the practical point of view, an understanding of these processes is crucial for providing teachers and other educational practitioners with guidelines and strategies that can help them to reflect on, revise and improve their practice.

1.2. Ways of organizing joint activity and mechanisms of educational influence

Research into the mechanisms of educational influence has generated a series of principles and a number of conclusions, which we will now summarize briefly[1].

First, educational influence is exercised in the context of the joint activity in which participants are involved. In the case of school-based teaching and learning processes, joint activity can be defined as an organized set of actions performed by students and the teacher in relation to a given task or learning content. Note that, in accordance with this definition, joint activity includes not only direct communicational exchanges between teacher and students but also other actions which, even if they are performed individually and separately, without mediation or interaction between the two parties, are nonetheless interlinked and can only be fully understood in relation to one another. Consider, for example, a teacher who, alone in her office, reviews the work produced by students, or students working in the library, preparing a dossier on a particular topic that they must present to their teacher. The activity in both cases is being performed independently, without interaction or communication between teacher and students. However, in order to understand what the teacher is doing, one needs to consider what she will do subsequently (and probably what she has already done) with her students; likewise, a proper understanding of what the students are doing requires consideration of the instructions they have been given by their teacher regarding the dossier's preparation (and also, probably, of what she will do subsequently when she appraises and comments on their work).

Second, joint activity can be organized in different ways, each a regular and recognizable format for structuring the actions of teacher and students in accordance

[1] A summary of these studies and their main findings can be found in Coll, Onrubia, & Mauri (2008).

with certain rules or 'structures of participation', both social and academic (Erickson, 1982; Green, 1983; Green, Weade, & Graham, 1988). From the perspective of educational influence, what is of interest here is that the way in which a joint activity is organized influences the types of learning support which may be offered, as well as their intensity and scope. In other words, the way in which joint activity is organized determines the educational influence that participants may exercise, and hence the study of these forms of organization and of how they evolve during teaching and learning activities is crucial for identifying and analysing the mechanisms of educational influence.

Third, mechanisms of educational influence operate through both the discursive and non-discursive actions of participants: a participant may help another or others by doing or saying something, or by doing and saying something at the same time. In fact, the discursive and non-discursive components of an activity are inseparable, since discourse readily becomes integrated within the general flow of an activity and mediates in equal measure the activity of all participants and their joint activity. The analysis of participants' discourse in the context of their joint activity around a task or learning content is thus an important aspect in the study of educational influence and its mechanisms.

Fourth, the exercise of educational influence is highly sensitive to the characteristics of the teaching and learning contexts and activities in which it manifests, as well as to the motives that underpin and guide the participants' activity. As already noted, educational influence is exercised in the context of joint activity, but it is not a static given, since it too is subject to a process of construction that depends, initially, on how the participants approach the teaching/learning situation and which is subsequently open to successive revisions and reformulations in response to changes in the situation and within participants themselves.

Fifth, research has identified and examined in some detail two mechanisms of educational influence associated with successful teaching/learning processes in the classroom. The first concerns the progressive transfer of control over and responsibility for the learning process from teacher to students. This mechanism involves the progressive withdrawal of support and help by the teacher, as a result of which students become increasingly independent and self-regulating in their behaviour, in the use they make of learning content and in the management of their own learning. The second mechanism involves the progressive construction of shared systems of meaning between teacher and students. Here, the support and help provided by the teacher is successively modified and evolves towards progressively richer, more complex and more valid representations of the content and tasks on which the joint activity is based, thereby enabling students' own representations of these tasks and content to evolve in the same direction.

To conclude this section on the background to the model of distributed educational influence, we wish to reiterate that the investigation of educational influence and its mechanisms is based on a broad set of theoretical proposals and research by other authors, such as the study of teaching and learning in the zone of proximal development (e.g. Newman, Griffin, & Cole, 1989; Rogoff, 1993; Wertsch, 1988), the

analysis of classroom discourse (e.g. Edwards & Mercer, 1988; Mercer, 1997, 2001) or the analysis of classroom ecology (Stodolsky, 1991; Tharp et al., 2002), among others.

2. From educational influence to distributed educational influence

The concept of educational influence, initially developed for the analysis of guided knowledge construction (Mercer, 1995) in the classroom, needs to be revised when applied to educational practices in contexts that are clearly different, such as collaborative knowledge building in digital environments. Normally, in guided knowledge construction, it is the teacher who exercises educational influence by offering help and support to students, and he or she does so through the face-to-face interaction and oral communication that are possible due to both parties being present in a shared space. In the case of collaborative knowledge building in digital environments, by contrast, all participants may exert varying degrees of educational influence, and at any given moment they can all offer and receive help from others; moreover, this is usually done via written communication, without face-to-face interaction, except for the occasional on-screen presence. Clearly, therefore, the concept of educational influence and the corresponding model of analysis need to be adapted and modified before being applied to these kinds of practices.

2.1. The exercise of educational influence in collaborative online learning processes

The starting point for these adaptations is the idea that the success of a collaborative learning process, in terms of its development and outcomes, will depend on the students' ability to assimilate and make effective use of the educational influence that the teacher is able to exercise in a situation of guided knowledge construction. Insofar as the outcomes which emerge from such a situation depend largely on the adequacy of the educational influence that the teacher exercises, we would argue that the outcomes in a collaborative learning situation likewise depend on all participants being able to take responsibility for exercising this influence and that what they do is adequate to the task in hand.

In this respect, we use the term distributed educational influence to refer to the fact that in collaborative learning contexts, not only are all the participants a potential source of educational influence but that this is precisely what is expected of them (Bustos, 2011). Obviously, they may not all exercise such an influence to the same extent or in the same way, and a given participant might specialize in offering a particular kind of help. This implies that the nature of distributed educational influence in collaborative groups may vary, that is, the way in which the participants in a collaborative process exercise educational influence and how this influence is distributed among them may take different forms. One might also hypothesize that different ways of distributing educational influence could give rise to clearly distinct dynamics of collaboration, which may nevertheless be equally successful in terms of the learning that is achieved by the group as a whole and by its individual members.

2.1.1. Conditions for the exercise of educational influence

When, however, collaborative learning takes place in digital environments, either totally or partially online, there are a number of important differences in the way in

which joint activity is organized, and therefore in the exercise of educational influence (Coll, Bustos, Engel, Gispert, & Rochera, 2013). These differences are mainly due to the restrictions imposed by the fact that participants primarily act, interact and contribute by means of written communication that is almost always asynchronous and often without direct visual contact. When it comes to the exercise of educational influence these restrictions pose different challenges to those involved in face-to-face settings, in which oral communication is the primary medium and where participants may employ paralinguistic and non-verbal resources, particularly body language and gestures.

In digital environments, therefore, the negotiation and revision of ways of organizing a joint activity, and hence the possibility of offering and receiving help, depends on the extent to which these challenges are met. For example, a prerequisite to this exchange of help is that participants log in with certain regularity and frequency. However, they also need to read the contributions of others with a similar regularity and frequency, as otherwise their own contributions will not be available as a potential aid to others, and they will be unable to take advantage of others' ideas in order to progress with their own learning. Those participants who fail to comply with these and other requirements implicit to digital environments will be greatly limited in their ability to exercise educational influence and contribute to the development of the collaborative learning process.

However, the collaborative learning process will not evolve, and neither will the exercise of educational influence be effective, simply because participants fulfil these prerequisites of participation. For that to occur, their contributions must also be relevant, that is, they must foster ways of organizing the joint activity, since it is the latter that provides the framework, at both the individual and group levels, for the construction and attribution of meanings in relation to the learning content. It is important again here to consider the restrictions imposed by digital environments. In face-to-face learning and teaching, the joint activity often takes forms that do not need to be spelled out, at least not in detail, as they are obvious to all those involved merely by being present. Only when someone says or does something unexpected or which is inconsistent with how the activity is being organized at a given moment does it become necessary to remind participants of the rules of participation, which until that point had remained more or less implicit. Even then, very little time is generally required to point out and admonish the unexpected actions, reminding participants of what is required of them. This is because face-to-face settings have a number of inherent features, notably the availability of certain communicative resources, shared physical and symbolic reference points, and the fact that any action taken can have an immediate effect. The exception to this would be when a serious misunderstanding or disagreement has occurred among participants with regard to how the joint activity should be organized, such that an open conflict emerges.

By contrast, most collaborative learning in digital environments involves written communication that is asynchronous and without direct visual contact, and this means that adopting certain ways of organizing the joint activity and respecting the rules that govern it generally requires greater attention and effort on the part of participants. In

order to co-construct a set of progressively richer, more complex and shared meanings about learning content, participants must agree on what they are going to do and how they are going to do it, as well as deciding who will do what and in what order, how their different actions will be coordinated, what products or outcomes they are going to generate, what requirements these products must fulfil, and how they are going to ensure that the process unfolds as planned. In other words, contrary to what occurs in face-to-face settings the way in which joint activity is organized in digital environments is not generally apparent to participants at the outset, merely by logging in. Indeed, the way in which the activity will be organized usually has to be spelled out, with considerable effort being required to ensure that participants understand the obligations and demands that result from this, and also to identify and admonish those actions which fail to meet these requirements, including reminding all those involved of what is expected of them.

2.1.2. Domains of educational influence

Given the greater demands and precision that is required of participants for collaborative learning in digital environments, our proposed approach to the study of distributed educational influence considers the contributions they make to the process of constructing meanings not only in relation to ways of organizing the joint activity but also with regard to the learning content itself. In this respect, we define three dimensions of knowledge building in collaborative learning environments: management of social participation, management of the academic task and content management (Coll, Bustos, & Engel, 2011). The first two dimensions concern meanings related to the organization of the joint activity, while the third refers to those related to the learning content. We also consider that both the development of the collaborative process and the outcomes of collaborative learning depend on the extent to which the educational influence that is exercised by participants as a group addresses these three dimensions.

The *management of social participation* refers to the actions, contributions and communicative exchanges related to the establishment of rules and instructions about who can or should do what, how, when, with whom and how often. *Management of the academic task* concerns the actions, contributions and communicative exchanges whose purpose is the establishment of rules and instructions about what has to be done, how it should be done and by what procedures, and what the final products should be, including a description of their characteristics. Both these dimensions are crucial for analysing and understanding how participants organize their joint activity and, thus, create a context which enables the construction and sharing of meanings in relation to the learning content. The third dimension focuses precisely on the *content management* that participants undertake in this context of joint activity, and it concerns the actions, contributions and communicational exchanges that are directly related to the meanings attributed to the learning content.

The concept of distributed educational influence derives from our consideration of the differential characteristics of the collaborative knowledge building process, and it is this, together with recognition of the particular challenges that digital environments pose for the exercise of educational influence, which has led us to develop a model for

analysing distributed educational influence. Before describing the current status of our model, however, it will be helpful to locate our understanding of distributed educational influence within the broader framework of theoretical and methodological approaches to collaborative learning in digital environments. This will enable us to highlight the specific features of our model for analysing distributed educational influence and, at the same time, to show how it relates to other models and approaches, such as the *community of inquiry* model (Garrison & Anderson, 2005; Rourke & Kanuka, 2009), to which it bears both certain similarities and a number of important differences.

3. The study of distributed educational influence in the context of research on collaborative learning in digital environments

It is clear from the specialist literature that there is considerable interest in the potential of collaborative processes in digital environments to promote learning among participants. A large number of studies fall under the broad umbrella of what is referred to as *computer-supported collaborative learning* (CSCL), others refer to learning communities or communities of inquiry, and some concern what is simply called collaborative online learning. Although all these studies have a common interest in understanding how digital environments may facilitate interaction, group work and collaborative knowledge building, they do so from a wide range of theoretical perspectives and with a variety of methodological approaches.

Broadly speaking, there are two types of studies: those that focus on analysing the learning outcomes achieved by students as a result of their participation in collaborative processes, and those that analyse the characteristics of collaborative contexts that lead (or fail to lead) to learning. In fact, many of the empirical studies in this field use experimental or quasi-experimental designs with the primary aim of measuring learning outcomes in the broadest sense, ranging from domain-specific knowledge or transferable competencies (such as critical thinking or problem-solving skills) to teamwork skills and attitudes. These studies are more concerned with the effects of collaboration on participants' individual or group learning than with describing the kinds of collaborative processes that enable this learning to be achieved (see, for example, the review by Wang, Kirschner, & Tsai, in press).

The common aim of the second group of studies, fewer in number, is to identify the characteristics of the collaborative process that might account for participants' learning in these situations. Although the authors of these studies seem to agree that there is a relationship between the characteristics of the group processes in which students are involved and their subsequent learning outcomes, they have different views regarding which aspects are key to successful collaboration and how to measure the success of this collaboration in terms of the learning achieved (Lund, 2011). Indeed, the diversity both of perspectives on collaborative learning processes and of researchers' focus of interest means that this is an extremely heterogeneous field of investigation. Nevertheless, it is possible to identify four distinct targets of research, corresponding to different dimensions of collaborative processes, which have

generated the most interest and number of studies. These are: i) the process of constructing meanings; ii) socio-affective and motivational aspects; iii) the dynamics of participation or communication; and iv) coordination and mutual regulation among students.

Some studies have analysed from a cognitive perspective the process through which meanings are constructed, focusing on the quality of participants' individual contributions (for example, Bullen, 1997; Newman, Johnson, Webb, & Cochrane, 1996), whereas others have emphasized the social aspects of collaborative knowledge building. The latter consider this to be a sequential process in which participants move from a position of divergent ideas and contributions to shared understanding, the convergence of ideas and the co-construction of meanings (for example, Gunawardena, Lowe, & Anderson, 1997; Harasim, 1990; Onrubia & Engel, 2009; Xin, 2002). There are also studies that analyse the construction of meanings according to the quality of the processes of argumentation in which participants engage. This approach considers learning to be directly related to the degree to which students are able as a group to reason and put forward evidence, from different points of view, in order to construct a shared understanding of the problem (see, for example, the exhaustive review by Noroozi, Weinberger, Biemans, Mulder, & Chizari, 2012).

A second focus of research that has given rise to a considerable number of studies concerns the socio-affective and motivational aspects of collaborative processes. The expression of emotion and feelings, the use of humour and the management of interpersonal conflicts are some of the elements considered by these studies in an attempt to understand the role that these relational, emotional and/or affective factors play in situations of collaborative learning and in relation to the learning that participants achieve (Gunawardena & Zittle, 1997; Janssen, Erkens, Kirschner, & Kanselaar, 2012; Kreijns, Kirschner, & Jochems, 2003; Tu & McIsaac, 2002).

The application of social network analysis methods has given rise to a third line of research, the focus of which are the structures of interaction and patterns of communication in collaborative learning processes (for example, Cho, Gay, Davidson, & Ingraffea, 2007; de Laat, Lally, Lipponen, & Simons, 2007; Nurmela, Lehtinen, & Palonen, 1999; Reffay & Chanier, 2003). Social network analysis offers a powerful set of concepts, procedures and measures, based on relatively standardized algorithms, for describing and explaining the structures of interaction or participation among members of a group (see, for example, Scott, 1991; Wasserman & Faust, 1994). Thus, indicators such as network density (describing the set of relationships between participants), centrality (identifying those participants who occupy central or peripheral positions in the network) or cohesion (in terms of the dyads or subgroups whose members show more intense relationships with one another than with the other participants) may be used to evaluate the dynamics of interaction among participants in a collaborative process.

The final set of studies comprises those which focus on specific aspects of group organization and functioning, such as planning, coordination and mutual regulation among participants (Iiskala, Volet, Lehtinen, & Vauras, 2015; Janssen, Erkens,

Kanselaar, & Jaspers, 2007; Jarvela & Hadwin, 2013; Volet, Vauras, Khosa, & Iiskala, 2013). Overall, these studies show that an important proportion of communication among group members is dedicated to planning, coordinating and supervising their joint work. The underlying idea here is that the process of co-constructing a system of shared meanings requires students to negotiate plans, goals, responsibilities, rules and schedules, to mutually supervise the completion of the agreed tasks and to evaluate as a group the process followed and the learning achieved.

It should also be noted that some studies consider two or three of the abovementioned topics of research — generally speaking, they focus on the construction of meanings plus one another dimension, for example, the socio-affective and motivational aspects (for example, Schrire, 2006), processes of coordination and mutual regulation (for example, Strijbos, Martens, Jochems, & Broers, 2004) or the dynamics of participation (for example, Martínez et al., 2003). Very few studies, however, are based on powerful theoretical models capable of providing a multidimensional and integrated view of collaborative learning processes.

A notable exception in this respect is the *community of inquiry* model proposed by Garrison, Anderson and Archer (2000). This model has probably had the greatest influence on the study and design of digital and hybrid learning environments, as is illustrated by the successive reviews of empirical studies that have applied it (Garrison, Anderson, & Archer, 2010; Garrison & Arbaugh, 2007; Kineshanko, 2016; Rourke & Kanuka, 2009, among others). The model comprises three dimensions or presences: cognitive presence, social presence and teaching presence. Garrison and Anderson (2005) define cognitive presence as the extent to which learners are able to construct meaning through sustained reflection and discourse. Social presence is the ability of participants in a community of inquiry to project themselves socially and emotionally as real people. Finally, teaching presence refers to the design, facilitation and direction of cognitive and communicative processes that enable participants to achieve personally meaningful and educationally worthwhile learning outcomes. For Garrison and colleagues, achieving an appropriate level of cognitive and social presence ultimately depends on the adequacy of teaching presence.

A particularly novel aspect of the concept of teaching presence proposed by Garrison and colleagues, and one which bears a clear resemblance to the concept of distributed educational influence, is that although the teacher is seen as playing a crucial role, it is emphasized that all participants, under certain circumstances, may also assume aspects of this role and contribute to teaching presence (Garrison & Anderson, 2005). In other words, the model makes a clear distinction between ‘presence of the teacher’ and ‘teaching presence’ in order to highlight that in communities of inquiry any participant may exercise teaching presence without formally being assigned the role and responsibilities of the teacher. A second important characteristic of the model is that the possibility of exercising teaching presence is considered to evolve and become more widely distributed among students as they become progressively able to take control and responsibility for the learning process.

As the authors themselves state:

> (…) *in a community of inquiry, the framework for our exposition, all participants have the opportunity to contribute to teaching presence. In fact, if the ultimate goal is learning to learn, students must be encouraged to develop the ability to self-monitor and to manage their own learning. This is even more evident in light of our proposal that moderators be appointed among the students. For this reason, we refer to this concept not as presence of the teacher but as teaching presence. As participants develop cognitively and socially, the more distributed teaching presence becomes*. (Garrison & Anderson, 2005, p. 104)

In this respect, the model of teaching presence (Garrison & Anderson, 2005) bears certain similarities to the model of distributed educational influence in that both emphasize the importance of distributing control and responsibility among all participants in order to develop the learning community. Where our model of distributed educational influence departs fundamentally from the model of teaching presence is in its interest in identifying and analysing the kinds of help that are offered, the extent to which they meet the needs of participants, how they evolve across the teaching/learning process and the patterns of interaction and communication in which they are located.

In the next section we describe the model of distributed educational influence, which, as noted, is focused specifically on analysing the different kinds of help and support that participants in collaborative digital environments offer one another with the aim of promoting individual and group learning.

4. The model for analysing distributed educational influence

4.1. The multimethod approach to the study of distributed educational influence

Our model for analysing distributed educational influence employs a multimethod approach which combines two types of analysis: structural analysis of participants' participation and interaction, and content analysis of their contributions from the perspective of the social, cognitive and communicative processes involved in their learning. The purpose of the former is to identify individual activity profiles that are potentially associated with the exercise of educational influence and to consider their relative importance within the group. The aim of the second is to establish the extent to which participants exercise educational influence and to identify the forms that this takes. The activity logs for the digital environment and the contributions (messages and documents) that participants make are the core sources of information on which these analyses are respectively based.

Multimethod approaches to the study of learning processes in digital environments have become a common feature of research over the past two decades. However, the precise approach employed varies considerably across studies depending on their aims and theoretical framework. In some cases the emphasis is on combining quantitative and qualitative methods (Hmelo-Silver, 2003), while in others it is about combining different levels of analysis (De Wever, Van Keer, Schellens, & Valcke, 2007; Martínez, Dimitriadis, Rubia, Gómez, & de la Fuente, 2003) or both individual and group

measures and indicators (Arvaja, Salovaara, Häkkinen, & Järvelä, 2007). In practically all cases, however, it is argued that a multimethod approach is the best option for studying learning processes in asynchronous networks. Furthermore, the approach taken by many authors involves the structural analysis of certain aspects of participation and interaction, combined with a content analysis of their contributions (de Laat, Lally, Lipponen, & Simons, 2007; Schrire, 2006).

4.2. Structural analysis of participants' activity: dimensions and indicators

The structural analysis of participants' activity includes a set of indicators and indices that are calculated both for individual participants and for the group as a whole (Bustos, 2011; Coll, Bustos, & Engel, 2011; Coll, Bustos, & Engel, 2015; Coll & Engel, 2014; Coll, Engel, & Bustos, 2009; Coll, Engel, & Niño, 2017; Engel, Coll, & Bustos, 2013; Niño, 2017). More specifically, the structural analysis considers indicators and indices regarding log-in and participation, on the one hand, and connectivity, on the other. The premise underlying both types of indicators and indices is that the nature and intensity of the help that is offered among participants, and hence the educational influence they may exercise, is determined by the degree to which they participate and become involved in the joint activity, as well as by the communicative exchanges that take place between them throughout the collaborative learning process.

4.2.1. Indicators and indices for log-in and participation

With respect to log-in and participation, the current version of our model includes five individual and three group indicators (see Table 1). For each one, we indicate the required form or the threshold value above which the presence of participants would, in theory, for the aspect or dimension in question, favour the exercise of educational influence. By simultaneously considering the five individual indices it is possible to establish activity profiles that can be evaluated in terms of the extent to which they correspond to the theoretically ideal profile for the exercise of educational influence.

INSERT TABLE 1 ABOUT HERE

The *individual access index* (IAI) is calculated by dividing the number of days on which each participant logs in to the digital learning environment by the total duration (in days) of the collaborative learning process. The hypothesis here is that there is a minimum number of log-in days below which it will be practically impossible for a participant to keep track of others' contributions, to offer help to other participants and, of course, to revise this help in response to the process. Generally speaking, the threshold value established for this index is 0.5, which implies that participants should log in on at least half the total number of days that the process lasts. However, this value can be adjusted depending on the specific characteristics of the collaborative learning process and the rules governing the interventions of participants. For its part, the *group access index (GAI)* is the total number of days that the various participants log in to the digital environment divided by the duration of the activity (in days) multiplied by the number of participants.

With respect to the exercise of educational influence, the continuity of log-ins is a

particularly important aspect. Those participants whose *individual log-in pattern* (ILP) includes long or fairly long periods with no log-in will clearly find it more difficult to exercise educational influence, since their absence from the digital forum will hamper their ability to keep track of others' contributions and to offer and receive timely help. The operational definition of what constitutes a degree of continuity conducive to the exercise of educational influence also depends, of course, on the instructions that participants are given regarding their involvement in the collaborative learning process, as well as on its duration.

The *individual reading index* (IRI) is the total number of contributions read by a given participant divided by the total number of contributions made by the other participants. The justification for this index is that in order to be in a position to offer timely and appropriate help, a participant must engage with the discursive context that is being constructed, and this is only possible by reading all or almost all of the contributions made by all or almost all of the other participants. Consequently, the value of this index should be high, and the closer it is to 1 the better placed the participant will be to exercise educational influence. The related *group reading index* (GRI) is calculated by dividing the total number of readings of the contributions of all participants by the total possible number of readings of the contributions made by all participants.

Contributing to the collaborative group activity by posting written messages — and also voice messages if the technology and design of the activity permit this — is the primary means through which participants offer and receive help in digital environments. Hence the importance of the *individual contributions index* (ICI), which corresponds to the total number of contributions made by each participant divided by the number of contributions required by the task instructions. The hypothesis here is that the number of individual contributions should be higher than the minimum established in the task instructions — anything less and the participant will struggle to offer timely help to others. Generally speaking, our model considers that the threshold value for the exercise of educational influence is a number of contributions at least 50% higher than the minimum required for each participant. The corresponding *group contributions index* (GCI) is calculated by dividing the total number of contributions made by all participants by the expected number of contributions of all participants based on the task instructions.

Finally, the *individual contributions pattern* (ICP) reflects the number of days during the collaborative learning process on which the participant makes at least one contribution. Here, our model establishes three levels: high, at least one contribution on between 60% and 100% of the total number of days; moderate, at least one contribution on between 40% and 59% of the total number of days; and low, at least one contribution on fewer than 40% of the total number of days. The hypothesis is that a *stable pattern*, that is, one in which the level of contribution is moderate or high and remains so across all periods or stages of the collaborative learning process, favours the exercise of educational influence, whereas this is not the case for a non-stable pattern showing a rising or descending trend, that is, a pattern in which the level of contribution jumps one or two levels from one period of the process to another, and always in the same direction (i.e. a rising or descending trend). Other

kinds of non-stable pattern are considered to be *undefined* with respect to their relationship to the exercise of educational influence.

By simultaneously considering the five individual indices and patterns of log-in and participation it is possible to establish a theoretically ideal activity profile for the exercise of educational influence. Consequently, the activity profiles of participants can be evaluated in terms of the extent to which they reflect the ideal profile and, therefore, favour the exercise of educational influence: the closer the match between a participant's activity profile and the ideal, the greater the likelihood that this participant will be able to exercise educational influence, that is, to help and support the other group members. Note also that the higher the number of participants in a forum with an activity profile that is close to or matches the ideal, the greater the distribution of educational influence in the group and the greater the likelihood that the group as a whole can offer help to its members. Table 2 shows, by way of an example, the theoretically ideal activity profile for the exercise of educational influence in a specific online collaborative learning process (for a description of the process on which this example is based, see Coll, Bustos, & Engel, 2015).

INSERT TABLE 2 ABOUT HERE

4.2.2. Indicators and indices of connectivity

The indicators and indices of *connectivity* that feature in our model for analysing distributed educational influence (see Table 1) are inspired by social network analysis (see, for example, Scott, 1991; Wasserman & Faust, 1997) and provide information about communicative relationships based on participants' direct responses to prior contributions of other group members. Of particular interest for the study of distributed educational influence are the reciprocal and responsive relationships as indicators of the interpersonal communication that is required to offer and receive help in the context of what is essentially a conversational form of learning. In this respect, our model includes one individual and two group indices of connectivity.

The *individual reciprocity index* (IRI) is the number of reciprocal communicative relationships that a participant establishes with other group members divided by the total possible number of these relationships that could be established. The rationale here is that those participants who establish reciprocal relationships with a higher number of participants and who, therefore, occupy a central position in the network of relationships, are better placed to exercise educational influence than are those group members with a more peripheral position. The related *group reciprocity index* (GRI) reflects the number of pairs of participants with a reciprocal connection, and it is calculated by dividing the total number of reciprocal dyads by the total number of possible reciprocal dyads.

Finally, the *network density index* (NDI) is defined as the number of actual communicative relationships that are established between participants divided by the total possible number of such relationships [n(n-1)]. The aim of this index is to capture the range of links or connections that are established between participants as a result

of the contributions they share with one another.

Although the structural analysis provides interesting information regarding log-ins and participation in digital environments and the interaction and communication between participants, it cannot give insight into the content, dynamics and effects resulting from the exercise of educational influence. Hence it needs to be complemented with a content analysis of participants' contributions that is able to provide information about the actual (rather than merely potential, as in the case of the structural analysis) exercise of educational influence, as well as about the different forms that this takes, how it is distributed and its complementarity in the collaborative learning process.

4.3. Content analysis of participants' contributions

The purpose of the content analysis of contributions is to identify the extent and nature of the educational influence that is actually exercised by participants. This analysis focuses on identifying contributions or fragments of contributions in relation to the three dimensions of joint activity that we defined in section 2 of this paper: the management of social participation, the management of the academic task and content management. By using techniques of thematic analysis and through an iterative process of constant comparison between the theoretical model of distributed educational influence and the data obtained from case studies conducted to date, we have identified for each of the three dimensions a series of categories that are listed and described (with examples) in Table 3.

INSERT TABLE 3 ABOUT HERE

The categories linked to *social participation* refer to the actions, contributions and communicative exchanges of participants that concern the establishment of rules and instructions regarding who can and should do what, how, when, with whom and how often, etc. These categories include the formulation of and reminders about the rules for participating in the activity, requesting or demanding clarification of these rules, participants' appraisal of the extent to which the rules have been followed, and proposals for revising or reformulating the rules.

The categories corresponding to *academic task* refer to the actions, contributions and communicative exchanges of participants related to the establishment of rules and instructions about what has to be done, how it should be done and by what procedures, and what the final products should be, including a description of their characteristics. These categories include reminders about the nature of the task or its requirements in relation to the expected outcomes or product, requests for clarification about the nature of the task and its requirements, proposals for reformulating these, and participants' appraisal of the extent to which the requirements have been met.

Finally, the categories referring to *content* concern what participants contribute and their involvement in the process of constructing progressively richer and shared meanings about the learning content and tasks. This dimension includes actions, contributions and communicative exchanges such as presenting information, raising

queries, requesting clarifications, recap and synthesis of information, giving positive or negative feedback with regard to the contributions of other participants, identifying and correcting errors, and expressing agreement and disagreement in relation to the learning content and tasks[2].

4.3.1. Indicators and indices for the dimensions associated with the exercise of educational influence: social participation, academic task and content management

As in the case of the structural analysis, we have defined — based on the coding of participants' contributions in relation to these dimensions and categories — three individual and three group indices that reflect the three dimensions associated with the exercise of educational influence (Coll, Engel, & Niño, 2017; Niño, 2017).

The *individual index for the management of social participation* (IIP) is the percentage of a participant's total contributions or fragments of contributions that focus on the rules or instructions about how to participate in the learning activity (for example, proposing rules of group participation, offering an opinion on these rules, asking for clarification of the rules, defining the roles that each participant should take, etc.). The corresponding *group index for the management of social participation* (GIP) reflects the percentage of the group's total contributions or fragments of contributions that concern the rules or instructions about how to participate in the learning activity.

The *individual index for the management of the academic task* (IIT) is the percentage of a participant's total contributions or fragments of contributions that focus on the rules or instructions related to the nature and requirements of the task, the steps to be followed in carrying it out or the characteristics of the final product (for example, asking for more details about the task, offering an opinion on the nature of the proposed task, proposing a way of performing the task, etc.). The equivalent *group index for the management of the academic task* (GIT) reflects the percentage of the group's total contributions or fragments of contributions that concern the nature and requirements of the task, the steps to be followed in carrying it out or the characteristics of the final product.

Finally, the *individual index for content management* (IIC) is the percentage of a participant's total contributions or fragments of contributions that are dedicated to negotiating or discussing the learning content (for example, providing information, asking others to comment on what has been provided, asking for more details about a contribution, identifying errors or gaps, developing a synthesis, etc.). The related *group index for content management* (GIC) reflects the percentage of the group's total contributions or fragments of contributions that are related to the learning content.

In accordance with the theoretical premises on which the concept of distributed educational influence is based (see above), participants in online collaborative learning environments must exercise educational influence in all three of the aforementioned dimensions if their joint activity is to avoid difficulties and misunderstandings and lead to satisfactory learning outcomes at both the individual and group levels. Consideration of all three dimensions of joint activity for the content analysis of

[2] For more details regarding the categorization of contributions and the procedures used to ensure reliability and consistency in the content analysis, see Coll, Bustos, and Engel (2011), Coll & Engel (2014) and Niño (2017).

participants' contributions also enables us to identify the different ways in which educational influence may be exercised in these different dimensions (see section 5.2. in this paper).

To conclude this general description of our model for analysing distributed educational influence, we would like to draw attention to the relationship between the structural analysis of activity and the content analysis of participants' contributions and their corresponding outcomes. Specifically, the results of analyses we have so far conducted on collaborative learning processes indicate that, generally speaking, those participants whose activity profile is closer to the ideal for the exercise of educational influence (measured through the structural analysis of activity) are also the most active in terms of the real extent to which this influence is exercised (based on the content analysis of their contributions).

5. Some applications of the model of distributed educational influence

Application of the model of distributed educational influence to different teaching and learning scenarios has enabled us to refine our theoretical approach to this concept and to develop our understanding of online collaborative learning. In what follows, we describe the empirical research that we have conducted in order to explore different core aspects of the model of distributed educational influence, as well as other more applied studies in which the model is used to encourage students to take real responsibility for being providers and recipients of help and to achieve a satisfactory distribution of educational influence in the group as a whole.

5.1. The model of distributed educational influence and activity profiles for the exercise of educational influence

Much of our research (Bustos, 2011; Bustos, Coll, & Engel, 2011; Coll, Bustos, & Engel, 2011; Coll, Engel, & Bustos, 2009) has focused on the structural analysis of participants' activity in digital environments. In each case study, and taking into account the nature of the teaching and learning activities involved, we have established for each of the indicators in the model of distributed educational influence (i.e. the individual indices of log-in, reading and contributions, as well as the pattern of log-ins and contributions) a threshold value for the effective exercise of educational influence category. The simultaneous consideration of these indices has enabled us to establish participation profiles that we could then evaluate in terms of the extent to which they correspond to the theoretically ideal profile for the exercise of educational influence in the specific collaborative learning scenario.

The results show that a structural analysis based on activity logs is able to identify both the level of distributed educational influence in the group, that is, the number of participants whose activity profile would potentially favour the exercise of educational influence, and also clear differences in participation profiles among students. These profiles can then be ordered according to how closely they reflect the theoretical ideal for the exercise of educational influence. The results confirm that, in general, those participants whose profile is closer to the ideal for the potential exercise of educational influence are also those who, based on the content analysis of their contributions, are the most active sources of this influence (and vice-versa, that is, the

least active students are those whose profile departs considerably from the ideal).

The results also show, however, that there is a far from perfect match between participation profiles and the exercise of educational influence. Some of the observed discrepancies may be due to shortcomings and limitations of the procedure and criteria used in each case study to produce the participation profiles and assess their suitability for the exercise of educational influence. However, these discrepancies also highlight the intrinsic limitations of structural analysis, which by its very nature is only able to show the extent to which participants meet the conditions required for the exercise of educational influence; importantly, this analysis provides no information about the content, dynamics and effects of the educational influence that group members may exercise. Thus, a content analysis of participants' contributions is also necessary in order to determine whether they actually exercise educational influence and to identify the forms this takes during the collaborative learning process.

5.2. The model of distributed educational influence and the individual exercise of educational influence

By considering the three dimensions of joint activity that underpin the content analysis of participants' contributions we have been able to identify different ways in which educational influence may be exercised (Bustos, 2011; Coll & Engel, 2014; Coll, Engel, & Niño, 2017; Niño, 2017). In our initial studies, we took into account the information provided by the individual indices of social participation, academic task and content, that is, we examined what, to what extent and at what point in the teaching/learning process participants contribute to the management of these three aspects.

The results of these analyses show that educational influence may indeed be exercised in different ways, either being concentrated in one or another of these dimensions or being more evenly spread across two or all three. More specifically, in the cases studied to date we have identified as many as seven different ways in which educational influence is exercised, and we have grouped them according to the following three categories: i) complete, in which educational influence is exercised in all three dimensions of joint activity (social participation, academic task and content); ii) partial/mixed, in which educational influence is exercised in two of the three dimensions of joint activity (content/academic task, content/social participation or academic task/social participation); and iii) specific, in which educational influence is exercised in only one of the three dimensions of joint activity (social participation or academic task or content).

However, this definition of the ways in which educational influence may be exercised tells us nothing about its impact on group dynamics during the collaborative learning process. In order to examine this impact for each of the groups featured in our most recent case studies on this question we have considered, in those studies, a further two sources of information that complements and modulates that provided by the individual indices of social participation, academic task and content. The first is the relative weight that the dimension to which an individual indicator refers has in relation to the group's contributions as whole. We believe it is reasonable to assume that when the contributions corresponding to a given dimension represent a very

small or very large proportion of the total number of contributions, the impact of this dimension (and therefore of its associated indices) will be considerably less or greater, respectively, than the impact of the other two dimensions. The second source of complementary information concerns the relationship between the number of contributions made by a particular group member on the dimension to which a given individual index refers and the mean number of contributions by all group members for that same dimension. The assumption here is that the impact of a participant whose individual index on a given dimension is higher than the value of the corresponding group index will be greater when that participant also makes a number of contributions above the group mean for that same dimension.

Consideration of these two sources of information complements that provided by the analysis of the ways in which educational influence is exercised since it offers insight into how these different ways are distributed within the group. Thus, we consider that a participant's contribution to the exercise of educational influence in a given dimension will have a greater impact on the dynamics of the collaborative process when the number of contributions made by that participant is equal to or above the median number of contributions made by the group as whole on that dimension.

Just as our theoretical model postulates that the ways in which individual group members exercise educational influence will differ according to the dimension or dimensions that they prioritize, so will educational influence be distributed in different ways in groups depending on how many and which of a group's members make an important contribution to the exercise of such influence, and also on the dimensions in which they do so. In some cases, for example, the exercise of educational influence may be evenly or fairly evenly distributed across the majority of group members on all three dimensions. Alternatively, the dimensions in which educational influence is primarily exercised may differ among sub-groups of participants.

Overall, the results suggest that in order to understand why certain collaborative processes prove to be constructive, or otherwise, it is necessary not only to identify how many participants actually exercise educational influence but also to analyse the different individual ways in which they do so, how these are distributed among group members as a whole and how these two aspects evolve across the collaborative learning process.

5.3. The model of distributed educational influence and formative e-feedback

Another topic we have addressed from the perspective of distributed educational influence is e-feedback and its role in supporting online collaborative learning in small groups (Coll, Rochera, de Gispert, & Díaz Barriga, 2013; Rochera, Engel, & Coll, 2016). The term *e-feedback* is commonly used to refer to a specific type of help, namely the information that is offered to learners in online learning environments with the aim of appraising their progress and guiding them towards the learning objectives (Narciss, 2008).

Our analysis of the characteristics of e-feedback considers four key aspects: i) its focus, insofar as it may provide information about the three dimensions of our model of educational influence (social participation, academic task and content); ii) its type,

distinguishing between verification (i.e. simply indicating whether an action was correct or incorrect) and elaboration (i.e. feedback that aims to guide the student's behaviour); iii) its target, that is, a given individual or the group as a whole; and iv) when it is offered.

The results of the studies carried out indicate that in collaborative situations all participants, both students and teachers, can offer help in the form of feedback on the knowledge building process. Furthermore, in order for collaboration to be fluid and for students to progress towards their learning goals, feedback must be targeted not only at the learning content but also at the characteristics and demands of the task and the social organization required to perform it, even if it is offered to varying degrees and at different points in the process.

5.4. The model of distributed educational influence and learning analytics

One set of studies among our more applied research explores the possibility of developing a learning analytic based on the model of distributed educational influence (Coll, Bustos, & Engel, 2015; Coll, Engel, & Niño, 2017; Niño, 2017). In this context, we have designed a learning analytic aimed at gathering activity data from an online learning platform, processing and interpreting it in light of the model of distributed educational influence and generating information that can be fed back in real time to students so as to encourage them to engage more actively as providers of help in the collaborative process. On this basis, we studied the impact that the information given to participants had on the collaborative process, its evolution and students' learning outcomes. We also explored whether the effect of the information provided differed according to whether i) it was derived from the structural analysis, the content analysis of participants' contributions or both analyses, and ii) it referred to the activity of individual participants or of the group as a whole.

The results of these studies show that providing participants with information about structural components (i.e. log-ins, participation and connectivity) and the content of their contributions (i.e. management of social participation, the academic task and content) has an immediate effect on the collaborative process and on the behaviour of individual students. Specifically, we observed i) an improvement in the individual and group indicators of log-in, participation and connectivity, ii) an improvement in the individual and group indicators for the management of social participation, the academic task and content, and iii) a wider distribution among group members for the exercise of educational influence. In all cases, however, this positive effect was not sustained throughout the collaborative process, despite the repeated presentation of information regarding participants' activity.

Regarding a possible differential effect due to the kind of information provided, the results are inconclusive. Some studies show that information of an individual nature has a clearer effect than group-related information. As for providing participants with information derived from the structural analysis, the content analysis or both analyses, the results reveal no differences related to the source of the information. Thus, the individual exercise of educational influence takes similar forms in all groups of a given case study. It is also worth noting that some results, while not conclusive, suggest that

the nature of the activity information given to participants may influence group dynamics in terms of how educational influence is distributed among group members.

5.5. The model of distributed educational influence and collaborative scripts

The aim of a second set of applied studies we have conducted (Engel, Coll, Vidosa, Salinas, & Niño, 2014; Engel, Rochera, Vidosa, Delgado, & Coll, 2016) has been to use the theory of distributed educational influence and our model for analysing it in order to develop guidelines or collaborative scripts that could guide learners in contexts of this kind, facilitating and fostering constructive dynamics of collaboration. On this basis, we asked students to design a script for their collaborative work, paying particular attention to three aspects. First, the script should be geared toward promoting the real exercise of educational influence among all participants, in other words, it should promote a broad distribution of educational influence. Second, because the collaborative process will only be fluid and effective if social participation, the academic task and the learning content are all adequately managed, the script had to include advice regarding these three aspects of joint activity. Third, insofar as the possibility of providing and receiving help, and therefore of exercising educational influence, depends on participants having a certain degree of presence and involvement in the learning tasks, the script had to clearly set out what is required of them in this regard and draw their attention to the importance of fulfilling these requirements. In addition, and in order to explore how much freedom students could be given without encouraging them to produce scripts that deviated considerably from their spontaneous working processes, we established two conditions: half of the groups were given general pointers about producing a collaborative script, while the other half were given detailed instructions.

The results indicate that students had a very positive view of the collaborative scripts they developed at the beginning of the process. Furthermore, they achieved good learning outcomes and reported that their collaborative work had improved as a result of the initial task they had been set. However, we found no differences according to whether a group of students had been given general or detailed instructions for developing a collaborative script. The teachers' ratings of group performance were also identical for these two conditions.

6. Developing the model: future perspectives

The results obtained in these studies show that the model of distributed educational influence can potentially be used not only to identify, describe and analyse collaborative processes in digital environments but also to support and guide these processes. However, a number of limitations are also apparent, thus highlighting the need for further research so as to continue developing and improving the model.

The first point is that our results also suggest that some of the structural indicators of log-in, participation and connectivity are better than others at indicating the extent to which participants fulfil the conditions associated with the exercise of educational influence. Future revisions of the model of educational influence should therefore reconsider the decision to award the same weight to the indices (of log-in,

participation and connectivity, as well as the patterns of log-in and contributions) used in determining the activity profiles regarded as most or least likely to favour the exercise of educational influence. The results obtained so far indicate that some indices, such as the individual reading index and the individual contributions index, should be given greater weight when drawing up these profiles.

Second, and as we noted earlier, it is important to identify not only how many participants actually exercise educational influence but also the different ways in which they do so and how these are distributed among them. In the cases studied to date, we have identified different kinds and degrees of individual educational influence depending on which of the three dimensions of joint activity are involved. However, aggregating the individual ways in which group members exercise educational influence has proven to be insufficient for understanding how educational influence is distributed in the group. There is a need therefore for new studies that pay particular attention to the different ways in which educational influence is distributed in groups, in terms of how many and which group members make an important contribution to the exercise of educational influence, and which also consider the effect that these different distributions have on the evolving group dynamics and the outcomes of the collaborative process.

Third, the results obtained indicate that the exercise of educational influence is determined by the characteristics and demands of the task and the learning content that is the focus of the collaborative process. The characteristics of participants, of the learning goals and content, of the task and of the technological resources available for carrying it out all influence the kind of collaborative relationships that may be established among group members. These considerations suggest that different models of educational influence, covering both its exercise and distribution, need to be defined according to the characteristics of the collaborative process and the conditions in which it takes place. This means that further progress in the design and development of a learning analytic based on the model of distributed educational influence will require giving up the search for an ideal model that is suitable for all collaborative processes and which remains valid whatever the specific characteristics of these processes are. On the contrary, what is needed is a tool with a system of indicators that can be weighted in order to define activity profiles that are most likely to favour the exercise of educational influence based on the specific characteristics of a teaching and learning scenario. The possibility of giving different weights to each of the indicators in the model of educational influence would enable the development of learning analytics that are flexible enough to be used in a wide range of digital learning environments, with different types of activities and with student groups of different characteristics.

Fourth, and with regard to the possibility of designing and developing a new learning analytic based on the model of distributed educational influence, more attention needs to be paid to the question of the meanings that participants may or may not attribute to the information provided by such a tool. Although none of the participants in our various studies had difficulty in correctly interpreting the indicators or activity profiles they were presented with, some participants were clearly incapable of assigning meaning to them, while others attributed an evaluative meaning that

differed from that attributed by the researchers and the teacher. It may be useful, therefore, to design and develop activities aimed at teaching students to make use of the information they are given for purposes related to the regulation and improvement of collaborative learning in digital environments.

Fifth, and as already noted, the results show that in collaborative processes the exercise of educational influence is distributed — in various ways and to varying degrees — among students and teachers. However, these results do not give insight into one of the most essential aspects of the exercise of educational influence, namely the fit or adequacy of the help offered in educational terms. In other words, the results do not tell us whether and to what extent educational influence that is exercised and distributed in a certain way is actually effective in helping students to learn. It is therefore necessary to develop analytic procedures that help to establish links and patterns of relationships, at both the individual and group levels, between the exercise of educational influence, processes of collaboration and learning outcomes.

Sixth, and to conclude, our model does not consider the socio-affective dimension of the collaborative process, one that is undoubtedly crucial for understanding how the joint activity of participants in a digital forum is organized. Indeed, the socio-affective and motivational aspects of students' approach to collaborative learning, together with the characteristics of the relationships they establish in the process, play a key role in how they go about co-constructing knowledge and in the meanings they attribute to their learning. The analysis of the different cases we have studied shows that these aspects, while not being an explicit topic of conversation among participants, aside from the conventional forms of greeting and farewell that are required by netiquette, are nonetheless reflected in many of the participants' contributions. Addressing these aspects, however, requires a different analytic approach to that described here, one which we aim to develop in future studies.

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Coll, C. and Engel, A. (2018). The Distributed Educational Influence Model: A Conceptual and Methodological Tool for the Analysis of Collaborative Learning Processes in Digital Environments. *RED. Revista de Educación a Distancia*, 58 (1). Consultado el (dd/mm/aaaa) en http://www.um.es/ead/red/58/coll_engel_eng.pdf

References

Arvaja, M., Salovaara, H., Häkkinen, P., & Järvelä, S. (2007). Combining individual and group-level perspectives for studying collaborative knowledge construction in context. *Learning and Instruction, 17*, 448-459.

Bullen, M. (1997). *A case study of participation and critical thinking in a university-level course delivered by computer conferencing*. Tesis doctoral no publicada, University of British Columbia, Vancouver, Canadá.

Bustos, A. (2011). *Presencia docente distribuida, influencia educativa y construcción del conocimiento en entornos de enseñanza y aprendizaje basados en la comunicación asíncrona escrita.* Tesis doctoral no publicada. Universidad de Barcelona, España. http://www.psyed.edu.es/prodGrintie/tesis/Tesis_A_Bustos_PresenciaDocenteDistribuida_V_web_2011.pdf

Cho, H., Gay, G., Davidson, B., & Ingraffea, A. (2007). Social networks, communication styles, and learning performance in a CSCL community. *Computers & Education, 49*, 309–329.

Coll, C. (1981). Naturaleza y planificación de las actividades en el parvulario. En C. Coll, *Aprendizaje escolar y construcción del conocimiento* (pp. 65-79). Barcelona: Paidós.

Coll, C. (1990). Un marco psicológico de referencia para la educación escolar: la concepción constructivista del aprendizaje y la enseñanza. En C. Coll, J. Palacios y A. Marchesi (Comps.), *Desarrollo psicológico y educación. II. Psicología de la educación* (pp. 435-453). Madrid: Alianza.

Coll, C. (1999). La concepción constructivista como instrumento para el análisis de las prácticas educativas escolares. En C. Coll (Coord.), *Psicología de la Instrucción: la enseñanza y el aprendizaje en la educación secundaria* (pp. 16-44). Barcelona: Horsori.

Colomina, R. (1996). *Interacción social e influencia educativa en el contexto familiar.* Tesis doctoral no publicada. Universidad de Barcelona, España.

Coll, C., Bustos, A.y Engel, A. (2011). Perfiles de participación y presencia docente distribuida en redes asíncronas de aprendizaje: la articulación del análisis estructural y de contenido. *Revista de Educación, 354,* 657-688.

Coll, C., Bustos, A. y Engel, A. (2015). La información sobre el ejercicio de la influencia educativa como medio para favorecer la participación y el aprendizaje en un foro en línea. *Infancia y Aprendizaje, 38*, 368-401.

Coll, C., Bustos, A., Engel, A., de Gispert, I., & Rochera, M. J. (2013). Distributed Educational Influence and Computer-Supported Collaborative Learning. *Digital Education Review*, 24, 23-42.

Coll, C., Colomina, R., Onrubia, J. y Rochera, Mª J. (1992). Actividad conjunta y habla: una aproximación al estudio de los mecanismos de influencia educativa. *Infancia y Aprendizaje, 59-60*, 189-232.

Coll, C. & Engel, A. (2014). Making meaning through joint activity in Computer-Supported Collaborative Learning (CSCL) settings: the interplay between content-related and activity-related talk. *Anales de Psicología, 30*(3), 818-831.

Coll, C., Engel, A., & Bustos, A. (2009). Distributed Teaching Presence and Participants' Activity Profiles: a theoretical approach to the structural analysis of Asynchronous Learning Networks. *European Journal of Education, 44*(4), 521-538.

Coll, C., Engel, A. y Niño, S. (2017). La actividad de los participantes como fuente de información para promover la colaboración. Una analítica del aprendizaje basada en el modelo de Influencia Educativa Distribuida. *RED, Revista de Educación a Distancia, 53.* http://www.um.es/ead/red/53/coll_et_al.pdf

Coll, C., Rochera, Mª.J., & De Gispert, I. (2014). Supporting online collaborative learning in small groups: Teacher feedback on learning content, academic task and social participation. *Computers & Education, 75* , 53-64.

De Laat, M., Lally, V., Lipponen, L. & Simons, R. (2007). Online teaching in networked learning communities: A multi-method approach to studying the role of the teacher. *Instructional Science*, *35*, 257-286.

De Laat, M., Lally, V., Lipponen, L., & Simons, R. J. (2007). Investigating patterns of interaction in networked learning and computer-supported collaborative learning: a role for social network analysis. *International Journal of Computer-Supported Collaborative Learning, 2*(1), 87–103.

De Wever, B., Van Keer, H., Schellens, T. & VALCKE, M. (2007). Applying multilevel modelling to content analysis data: Methodological issues in the study of role assignment in asynchronous discussion groups. *Learning and Instruction*, 17, 436-447.

Edwards, D. y Mercer, N. (1988*). El conocimiento compartido. El desarrollo de la comprensión en el aula*. Barcelona: Paidós (Publicación original en inglés en 1987)

Engel, A., Coll, C., & Bustos, A. (2013). Distributed Teaching Presence and communicative patterns in asynchronous learning: Name versus reply networks. *Computers & Education, 60,* 184-196.

Engel, A., Coll, C., Vidosa, H., Salinas, P. y Niño, S. (2014). El uso de pautas de trabajo colaborativo para la distribución de la influencia educativa. Comunicación presentada en el VIII Congreso Internacional de Docencia Universitaria e Innovación (CIDUI). Tarragona, 2, 3, y 4 de julio.

Engel, A., Rochera, M. J., Vidosa, H., Delgado, S. y Coll, C. (2016). Orquestar ayudas para el aprendizaje colaborativo: herramientas, guiones y retroalimentaciones. Comunicación presentada en el VIII Congreso Internacional de

Docencia Universitaria e Innovación (CIDUI) *Impactos de la innovación en la docencia y el aprendizaje*. Cerdanyola del Vallès, 5-7 de julio 2016.

Erickson, F. (1982). Classroom discourse as improvisation: relationships between academic task structure and social participation structure. En L. CH.Wilkison (comp.), *Communicating in the classroom* (pp. 153-181). New York: Academic Press.

Garrison, D. R. & Anderson, T. (2005). *El e-learning en el siglo XXI: investigación y práctica.* Barcelona: Octaedro. (Publicación original en inglés 2003).

Garrison, D. R., Anderson, T., & Archer, W. (2000). Critical inquiry in a text-based environment: Computer conferencing in higher education. *Internet and Higher Education, 2*(2–3), 87−105.

Garrison, D. R., Anderson, T., & Archer, W. (2010). The first decade of the community of inquiry framework: A retrospective. *The internet and higher education*, *13*(1-2), 5-9.

Garrison, D. R. & Arbaugh, J. B. (2007). Researching the community of inquiry framework: Review, issues, and future directions. *The Internet and Higher Education*, *10*(3), 157-172.

Green, J. L. (1983). Research on teaching as a linguistic process: a state of the art. *Review of Research in Education*, *10*, 151-252.

Green, J. L., Weade, R. & Graham, K. (1988). Lesson construction and student participation: A sociolinguistic analysis. En J. L. Green y J. O. Harker (eds.), Multiple perspectives analysis of classroom discourse (pp. 11-47). Norwood, NJ: Ablex.

Gunawardena, C., Lowe, C., & Anderson, T. (1997). Analysis of a global online debate and the development of an interaction analysis model for examining social construction of knowledge in computer conferencing. *Journal of Educational Computing Research, 17*(4), 395-429.

Gunawardena, C. N. & Zittle, F. (1997). Social presence as a predictor of satisfaction within a computer mediated conferencing environment. *American Journal of Distance Education, 11(*3), 8-25.

Harasim, L. (1990). Online education: An environment for collaboration and intelectual amplification. En L. M. Harasim (Ed.), *Online education: Perspectives on a new environment* (pp. 39-63). New York, NY: Praeger Pulishers.

Hmelo-Silver, C. E. (2003). Analyzing collaborative knowledge construction: Multiple methods for integrating understanding. *Computers & Education, 41*, 397-420.

Iiskala, T., Volet, S., Lehtinen, E., & Vauras, M. (2015). Socially shared metacognitive regulation in asynchronous CSCL in science: Functions, evolution and participation. *Frontline Learning Research*, *3*(1), 78–111.

Janssen, J., Erkens, G., Kanselaar, G. & Jaspers, J. (2007). Visualization of participation: Does it contribute to successful computer-supported collaborative learning?

Computers & Education, 49, 1037–1065.

Janssen, J., Erkens G., Kirschner P., & Kanselaar, G. (2012). Task-related and social regulation during online collaborative learning. *Metacognition and Learning, 7*(1), 25-43.

Jarvela, S., & Hadwin, A. H. (2013). New Frontiers: Regulating Learning in CSCL. *Educational Psychologist, 48*(1), 25-39.

Kineshanko, M. K. (2016). *A thematic synthesis of Community of Inquiry research 2000 to 2014*. Tesis doctoral no publicada. Athabasca University. https://dt.athabascau.ca/jspui/handle/10791/190

Kreijns, K., Kirschner, P.A., & Jochems, W. (2003). Identifying the pitfalls for social interaction in computer-supported collaborative learning environments: a review of the research. *Computers in Human Behavior, 19*, 335-353.

Lund, K. (2011). Analytical frameworks for group interactions in CSCL systems. In S. Puntambekar et al. (eds.) *Analyzing Interactions in CSCL* (pp. 391-411). Springer, Boston, MA.

Martínez, A., Dimitriadis, Y., Rubia, B., Gómez, E. & de la Fuente, P. (2003). Combining qualitative evaluation and social network analysis for the study of classroom social interaction. *Computers & Education, 41*, 353-368.

Mayordomo, R. (2003). *Interactividad y mecanismos de influencia educativa. La construcción del conocimiento en niños sordos integrados en la escuela ordinaria*. Tesis doctoral no publicada. Universidad de Barcelona, España.

Mercer, N. (2001). *Palabras y mentes. Cómo usamos el lenguaje para pensar juntos.* Barcelona: Paidós (Publicación original en inglés en 2000).

Mercer, N. (1997). *La construcción guiada del conocimiento. El habla de profesores y alumnos.* Barcelona: Paidós (Publicación original en inglés en 1995).

Mercer, N. (1995) *The Guided Construction of Knowledge: talk amongst teachers and learners.* Clevedon: Multilingual Matters.

Narciss, S. (2008). Feedback strategies for interactive learning tasks. *Handbook of research on educational communications and technology*, *3*, 125-144.

Newman, D., Griffin, P., & Cole, M. (1989). *The construction zone: Working for cognitive change in school*. Cambridge, UK: Cambridge University Press.

Newman, D.R., Johnson, Ch, Webb, B. & Cochrane, C. (1996). Evaluating the quality of learning in Computer Supported Co-operative Learning. *Journal of the American Society for Information Science,* 48(6), 484-494.

Niño, S. (2017). *El uso de la información sobre el ejercicio de la influencia educativa*

para la mejora de los procesos y los resultados del aprendizaje colaborativo en entornos digitales. Tesis doctoral no publicada. Universidad de Barcelona, España.

Noroozi, O., Weinberger, A., Biemans, H. J., Mulder, M., & Chizari, M. (2012). Argumentation-based computer supported collaborative learning (ABCSCL): A synthesis of 15 years of research. *Educational Research Review*, *7*(2), 79-106.

Nurmela, K., Lehtinen, E. & Palonen, T. (1999). Evaluating CSCL log files by social network analysis. In *Proceedings of the 1999 Conference on Computer Support for Collaborative Learning* (p. 54). International Society of the Learning Sciences

Onrubia, J. (1992). *Interacción e influencia educativa: aprendizaje de un procesador de textos.* Tesis doctoral no publicada. Universidad de Barcelona, España.

Onrubia, J., & Engel, A. (2009). Strategies for collaborative writing and phases of knowledge construction in CSCL environments. *Computers & Education, 53*(4), 1256–1265.

Reffay, C., & Chanier, T. (2003). How social network analysis can help to measure cohesion in collaborative distance-learning. In B.Wasson, S. Ludvigsen & U. Hoppe (eds), *Designing for change in networked learning environments* (pp. 343-352). Springer, Dordrecht.

Rochera, Mª. J. (1997). *Interactividad e influencia educativa: análisis de algunas* actividades *de enseñanza y aprendizaje de los primeros números de la serie natural en Educación Infantil*. Tesis doctoral no publicada. Universidad de Barcelona, España.

Rochera, Mª.J., Engel, A. y Coll, C. (2016). El efecto del feedback del profesor en foros de discusión en línea. Comunicación presentada en la IV Conferencia Internacional Virtual sobre Innovación, Documentación y Tecnologías Docentes, "Lean education and innovation" INNODOCT 2016. Valencia, 18 - 20 de mayo.

Rogoff, B. (1993). *Aprendices del pensamiento. El desarrollo cognitivo en el contexto social*. Barcelona: Paidós.

Rourke, L. & Kanuka, H. (2009) Learning in Communities of Inquiry: A Review of the Literature. Journal *of Distance Education*, *23*(1), 19-48.

Schrire, S. (2006). Knowledge building in asynchronous discussion groups: Going beyond quantitative analysis. *Computers & Education, 46*, 49-70.

Scott, J. (1991). *Social Network Analysis: A Handbook*. First edition. London: Sage Publications.

Segués,T. (2006). *Interacció entre infants i formes d'organització de l'activitat conjunta.* Tesis doctoral no publicada. Universidad de Barcelona, España.

Stodolsky, S. (1991). *La importancia del contenido en la enseñanza. Actividades en las clases de matemáticas y ciencias sociales*. Barcelona: Paidós (Publicación original en

inglés en 1988).

Strijbos, J. W., Martens, R. L., Jochems, W. & Broers, N. J. (2004). The effect of functional roles on group efficiency: Using multilevel modelling and content analysis to investigate computer-supported collaboration in small groups. *Small Group Research*, *35*(2),195-229.

Tharp, R. G., Estrada, P., Stoll, D. S. y Yamauchi, L. A. (2002). *Transformar la enseñanza. Excelencia, equidad, inclusión y armonía en las aulas y las escuelas*. Barcelona: Paidós. (Publicación original en inglés en 2000).

Tu, C.H., & McIsaac, M. (2002). The relationship of social presence and interaction in online classes. *The American Journal of Distance Education*, *16*(3), 131-150.

Volet, S., Vauras, M., Khosa, D., & Iiskala, T. (2013). Metacognitive regulation in collaborative learning: Conceptual developments and methodological contextualizations. In S. Volet and M. Vauras (Eds.), *Interpersonal regulation of learning and motivation: Methodological advances* (pp. 67–101). London & New York: Routledge.

Wasserman S. & Faust K. (1994) *Social Network Analysis: Methods and Applications*. Cambridge, UK: Cambridge University Press.

Wang, M., Kirschner, P. A., & Tsai, C. C. (en prensa). The Role of Collaboration, Computer Use, Learning Environments, and Supporting Strategies in CSCL: A Meta-Analysis. *Review of Educational Research* https://doi.org/10.3102/0034654318791584

Wertsch, J. V. (1988). Vygotsky y la formación social de la menta. Barcelona: Paidós. (Publicación original en inglés en 1985).

Xin, M. C. (2002). *Validity centred design for the domain of engaged collaborative discourse in computer conferencing*. Tesis doctoral no publicada. Brigham Young University, UTA, Estados Unidos. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.115.3532&rep=rep1&type=pdf

Table 1. Structural indicators and indices for log-in, participation and connectivity

Individual indicators	Group indicators
Individual access index (IAI) Total number of log-in days per participant divided by the total duration (in days) of the activity.	**Group access index (GAI)** Total number of log-in days for the group as a whole divided by the total duration (in days) of the activity multiplied by the number of participants.
Individual log-in pattern (ILP) Continuous: the participant has no period of more than X days without a log-in. (*) Discontinuous: the participant has one or more periods of more than X days without a log-in. (*)	---
Individual reading index (IRI) Total number of contributions read by a given participant divided by the total number of contributions made by the other participants.	**Group reading index (GRI)** Total number of readings of the contributions of all participants divided by the total possible number of readings of the contributions made by all participants.
Individual contributions index (ICI) Total number of contributions made by a participant divided by the number of contributions required of each participant.	**Group contributions index (GCI)** Total number of contributions made by all participants divided by the expected number of contributions by all participants based on the task instructions.
Individual contributions pattern (ICP) Continuous: the participant makes a permanent contribution across all days of the activity. Discontinuous: the participant makes intermittent contributions that are concentrated on certain days of the activity.	---
----	**Network density index (NDI)** Total number of actual communicative relationships between participants divided by the total possible number of such relationships [n(n-1)].
Individual reciprocity index(IRI) Total number of reciprocal communicative relationships that a participant establishes with others divided by the total possible number of these relationships that could be established.	**Group reciprocity index (GRI)** Total number of reciprocal dyads divided by the total possible number of reciprocal dyads.

(*) The value of X will vary according to the specific characteristics of the collaborative learning process and the instructions and rules governing the participants' interventions.

Table 2. Theoretically ideal individual activity profile for the exercise of educational influence (adapted from Coll, Bustos, & Engel, 2015)

Individual indices	**Theoretically ideal individual activity profile for the exercise of educational influence**	**Interpretation from the perspective of educational influence**
Individual access index	≥ 0.5	Logging in on over half the number of days the activity lasts increases the likelihood of communicative exchanges that enable help to be offered and received.
Individual log-in pattern	Continuous	A continuous pattern of log-ins allows the participant to keep better track of others' contributions and to offer and receive timely help.
Individual reading index	≥ 0.9	A reading percentage close to 100% favours the establishment of a shared discursive context and increases the likelihood of offering and receiving help.
Individual contributions index	≥ 1.5	When a participant makes more contributions than the minimum required by the task instructions there is greater likelihood of offering and receiving help.
Individual contributions pattern	Evenly spread	A balanced pattern of contributions increases the likelihood of offering and receiving help from the other participants.

Table 3. Content analysis of participants' contributions: dimensions, categories and examples
Dimension: social participation

Description	Example
Formulation or reminder of the rules of participation or action for participants	Principle of participative balance: if the product has to be collective, participation must tend towards balance. This is not new, but we followed the line of "minimum intervention" and no maximum limit. What I would now say is that we need to be alert while we participate, making sure everybody is doing it (I know it is difficult); that the silences speak volumes [teacher, case 2]
Request or requirement for clarification of the rules of participation or action for participants	The "format" of interaction is new, for me at least, and I'm not too clear about procedures like 'how long do you wait for your next turn?', 'how do we decide to go on to the next point in the debate?'... [student]
Formulation of clarification of the rules of participation or action for participants, by request of other participants	Try not to open so many lines of discussion – only when you really need to – and read all the messages from your group and from me. (in the group forum and the news forum) [teacher]
Proposal for revision or reformulation of the rules of participation or action for participants	Supporting Maria[3] and Veronica would be more dynamic and useful – if we're aiming to share and construct together – we should be more concise and explicit [student]
Evaluation of the rules of participation or action for participants or of the proposals for rules of participation or action for participants: positive (agreement, relevance, interest...), negative (disagreement, degree of requirement...), expression of doubts or confusion	Luisa, as I've already said to other teams, the work forum is perfectly sufficient for working on the product for block 1. Other teams have proved it, they're on the point of finishing their map, working on reciprocal interaction exclusively through the forum without using the chat even once [teacher]
Evaluation of the extent to which the rules of participation or action for participants are followed: positive (evidence of respect or compliance), negative (evidence of lack of respect or non-compliance)	Please, everyone, because I think we've got a good few activities and the work could be shared out more fairly, I'd like not to have to feel the absence of some of the team members [student]

[3] In order to protect people's identities, the participants' names have been changed.

Dimension: academic task

Description	Example
Formulation or reminder of the characteristics or requirements of the task, how to tackle it, and its product or result	I think that to make it easier we should be outlining the competencies for all the material we have and justifying the outline or competency we propose, and then it will be easier for Juan to put them all together and, as the teacher says, not get carried away with it all [student]
Request or requirement for clarification about the characteristics or requirements of the task, how to tackle it, and its product or result as regards both its initial version and any possible proposals for reformulation	The first thing I want to know is whether what we're meant to be doing or the aim of the forum is to look at the subject of "objectivism and subjectivism" on a conceptual analysis level of "epistemological problem" or at a level of "methodological problem", i.e. at a level where theories of quantitative or qualitative methodology tackle the subject [student]
Request or requirement for clarification about the characteristics or requirements of the task, how to tackle it, and its product or result, by request of other participants	It's obvious that the discussion has to have an epistemological level and an applicational, methodological level. I think we should start with the first but without completely forgetting the second [teacher]
Proposal for revision or reformulation of the characteristics or requirements of the task, how to tackle it, and its product or result	A week before the end of the forum, I think we should work on a very specific task to enable us to arrive at some sort of shared conclusion (even if it's only a very limited part) [student]
Evaluation of the task characteristics or requirements, how to tackle it, and its product or result as regards both its initial version and any possible reformulations: positive (agreement, relevance, interest...), negative (disagreement, degree of requirement...), expression of doubts or confusion	I think what Manuel proposed is interesting, that we base the competency we contribute not just on an article or document, but on the product handed in last week, which is the teaching scenario. That's our guide for proposing competencies [student]
Evaluation of the degree of respect for or fulfillment of the requirements of the task, how to tackle it, and its product or result: positive (evidence of respect or compliance) or negative (evidence of lack of respect or non-compliance)	Despite this I really believe that we're doing a good job because we're managing to construct shared meanings (through written language in this case, and that's not bad at all) [student]

Dimension: **learning content**

Description	Example
Contribution on own initiative of own meanings, presented as own with a certain degree of preparation (development, enlargement, details)	Obviously it has to be considered that thanks to discussing the case in the subject group chosen, relevant topics are looked at (as far as I can see it would be “Special Education" and the topic "Educational Integration") and relevant content learnt. After the dilemma come the characters and then the narrative gets structured [student]
Contribution on own initiative of meanings attributed to external sources or reference to one or more sources of meanings, with a certain degree of preparation (development, enlargement, details)	Perrenoud works out the figure of the ideal teacher based on a dual record of citizenship and construction of competencies [student]
Contribution of meanings via attached documents written by self or other	And on the same subject, I’d like to include an article on qualitative research that seems to me to specifically provide a general view of the subject. I hope you find it useful for getting to grips with the key ideas we’ve been discussing! [student]
Literal or almost literal reminder of meanings previously presented by other participants	As far as the study questions are concerned, the question "What should Carlos’s parents do, take him out of school and keep him at home even though this decision may affect his development? Why?" I feel suggests an answer, even if it doesn’t completely fit the discussion [student, case 3]
Request for other participants to contribute meanings about a topic or to comment on meanings contributed by whoever formulates the request	With all that’s been said, I’m still not clear about it. What exactly are the mechanisms that enable us to interthink? What happens not only in the conversation exchange, in the subject, to enable us to understand or try to understand the reference framework and the content of its speaker? [student]
Reply to a request from another participant to contribute meanings about a topic or to comment on meanings contributed by whoever formulated the request	It seems to me, Luisa Fernanda, that the question you propose of the psychological mechanisms involved in the "interthinking" is a very interesting issue and one that we should formulate as we move forward in the book. For now, in chapter 3 – the given and the new – there is a series of strategies, techniques to enable us to understand the links in meaning between the new and the given (recapitulation, reformulation...). Mercer also talks about "cohesive resources" (like repetition and anaphoric reference) as techniques for establishing a "connected meaning" in the course of the comprehension process (spoken or written) [student, replying to a previous contribution]
Favourable assessment (signs of agreement and acceptance) of meanings previously contributed by other participants	The case is well outlined, the characters are valid and their attitudes are believable. [teacher]

Critical assessment (signs of fairly formal and forceful disagreement or difference) of meanings previously contributed by other participants	But (there's always a but in this life) you still need to polish the work, give it a more precise focus for this scenario, argue more about occupational training teachers and the teaching they give, their needs and the problems involved in teacher training. OK? [teacher]
Identification of topics or subjects for attention, further study and discussion	According to the scenario given and to one of the main problems facing occupational training teachers, I suggest we evaluate two groups of competencies, last week's product. Which ones? Types of teaching and the teacher's teaching methodology. The other group would be the assessment group. [student]
Request to another participant for details, clarification or explanations about meanings they previously presented	But I don't see how we can approach the question methodologically if we don't agree at an epistemological level about the need to revise the rules, concepts and tools. Can you explain your idea a bit more? [student]
Reply to a request for details, clarification or explanations from another participant about meanings previously presented by the person replying	For me the biggest problem isn't the positioning in an epistemological option, but rather the availability of a methodological infrastructure. We can obviously go much more deeply into the conceptualization of an epistemological option focused on the subjective, i.e. that involves an emic-type approach to the subject studied. However, I think we would quickly agree that this option is possible and can be scientific (objective), with the way of understanding these terms that the option implies, a question that has been discussed a little in this forum [student, replying to a previous contribution]
Identification and/or correction of errors, incomprehension or omissions (real or not) in the meanings previously contributed by others or by self	No, remember that it isn't a case in itself (like those that appear in the files of an institution). What has to be developed is a controversial case that involves a dilemma and can generate a discussion with at least two possible solutions or standpoints [teacher]
Expression or signs of doubt, unanswered questions, incomprehension or uncertainty about one or more of the topics that are being discussed	Well, I still have the feeling we're not moving ahead (maybe this is the objective or I just don't understand enough), we still have the need and interest to look for the approach to objectivity with subjectivity in order to find out what we think is subjective about human knowledge, with observable and quantifiable measurements. I keep coming up against a brick wall. Am I the only one that feels like that? [student]
Formulation of synopses, summaries or recapitulations including meanings previously contributed by self and by other participants	And then my summary (including my interpretation) of the readings I sent them, which have to be tested against the scenario and the competencies we noted, in order to establish the rubric: Trends in teaching odontology have moved from a disciplinary approach (by subject) and from a master (explanatory) class (teaching) to an approach based on competencies and focusing on the students' learning [student]

Coll & Engel (2014)