

# Knowledge construction and regulation of learning in asynchronous collaborative tasks

## Construcción del conocimiento y regulación del aprendizaje en tareas colaborativas asíncronas

<http://dx.doi.org/10.32870/Ap.v11n1.1465>

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### ABSTRACT

#### Keywords

Collaborative learning,  
higher education,  
knowledge construction,  
regulation of learning,  
virtual learning

This article presents the results of a research developed with students of bachelor's degree in education from Autonomous University of Baja California, Mexico. In six small groups of students, collaborative learning processes in asynchronous communication technology environments were analyzed. Through a multiple case study methodology, the discourse displayed by the students during their collaboration was analyzed with a double focus: the cognitive discourse oriented to the knowledge construction and the discourse aimed to regulate the task. The results highlights that the establishment of goals, the formulation of positive expectations about the task, the monitoring of progress and the socio-emotional support are regulatory mechanisms that contribute strongly to the development of rich and profound processes of shared knowledge construction. A positive effect of the regulatory discourse on the cognitive activity of students is concluded.

### RESUMEN

#### Palabras clave

Aprendizaje virtual,  
aprendizaje colaborativo,  
construcción del  
conocimiento, educación  
superior, regulación del  
aprendizaje

*Este artículo presenta los resultados de una investigación desarrollada en la Universidad Autónoma de Baja California, México, con estudiantes de la Licenciatura en Ciencias de la Educación. Se analizaron procesos de aprendizaje colaborativo en entornos tecnológicos de comunicación asíncrona en seis pequeños grupos de estudiantes. Mediante una metodología de estudio de casos múltiples, analizamos el discurso utilizado por los estudiantes durante su colaboración desde un doble enfoque: el discurso cognitivo orientado a la construcción del conocimiento y el discurso utilizado para la regulación de la tarea. Los resultados muestran que el establecimiento de metas, la formulación de expectativas positivas sobre la tarea, el monitoreo de los progresos y el apoyo socioemocional son mecanismos reguladores que contribuyen fuertemente al desarrollo de procesos ricos y profundos de construcción compartida del conocimiento. Nuestro estudio revela un efecto positivo del discurso regulador sobre la actividad cognitiva de los estudiantes.*

Received: September 29, 2018  
Accepted: December 18, 2018  
Online Published:  
March 30, 2019

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## INTRODUCTION

The technological development of different platforms for online learning (Learning Management System, LMS; for example, Moodle, Claroline, Blackboard, Sakai, among others) has significantly influenced the reconfiguration of traditional educational systems by moving from a teacher-oriented approach as the main educational agent to a student-centered paradigm as active actors in their formative processes (Blüch, Ellis, Goodyear & Piggott, 2011; Conde Gonzáles et al., 2014).

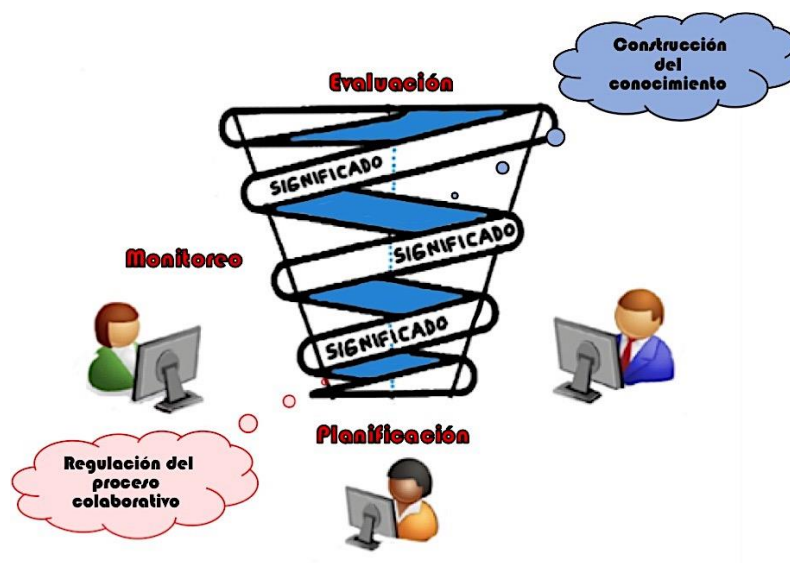
These LMS platforms allow the students to develop their learning by using different tools incorporated to virtual classrooms (Hamada & Hassan, 2017), e.g., the academic calendar, document repositories, multimedia material, e-mail, chat, forums, Wikis, among others. The combination of different means of access to information and communication channels in the same digital environment make these spaces environments conducive to the self-regulation of learning and the construction of shared knowledge (De Oliveira, Cunha & Nakayama, 2016; Johnson, 2016).

An essential characteristic of LMS platforms are asynchronous communication tools designed to help students collaborate through computer systems connected to the net without any type of special or time restriction. Oztok, Zingaro, Brett & Hewitt (2013), Castro Mendéz, Suárez Cretton and Soto Espinoza (2016) and Castellanos Ramírez and Niño Carrasco (2018) have stressed that asynchronous communication offers great advantages for students learning; e.g., the participation in these platforms based on written language reinforces organization, systematization, expression and idea argumentation skills. The accumulation of contributions in asynchronous forums makes it easier for students to make metacognitive judgments on previously submitted ideas; they provide the opportunity to have multidirectional communication while students can hold conversations with several peers on different topics in a same time space; furthermore, they allow the students greater flexibility to work according to their own schedule.

According to Coll and Engel (2014), Mayordomo and Onrubia (2015), Zheng (2016) and Koivuniemi, Panadero, Malmberg and Järvelä (2017), asynchronous collaboration requires twofold effort from the students. On the one hand, participants must get involved in a cognitive discourse on the contents of the task and, on the other hand, regulate the context in which the cognitive activity of the group occurs.

Figure 1 shows that the studies on the construction of shared knowledge aim at analyzing the cognitive process of discussion and revision of ideas (meanings) that lead to the advancement of the group's knowledge since "students engage in sustained idea improvement and collectively advance the state of the art of their community knowledge" (Zhang et al., 2011, p. 267). In empirical terms, the regulation of the learning is defined as the control students have on their collaborative processes and their study

involves identifying metacognitive strategies to manage the task. Järvelä and Hadwin (2013) recommend that the “research about regulated learning must explicitly attend to monitoring and controlling processes such as activating self/group, task, and strategy knowledge, planning, monitoring, evaluating, or strategically adapting commitment” (p. 26).



**Figure 1.** Processes involved in collaborative learning: shared regulation and construction of shared knowledge.

So far, most of the research on online collaborative learning has focused on analyzing student cognitive processes from a threefold approach:

- Knowledge convergence (Puntambekar, 2006; Weinberger, Stegmann & Fischer, 2007). This line of studies focuses on the evaluation of changes that occur in students' mental representations as a result of the collaborative process, gradually passing from the divergence to the convergence of ideas.
- Argumentative quality (Stegmann, Weinberger & Fischer, 2007; Clark & Sampson, 2008). This group of research explores the structure and composition of arguments students use during their activity in forums (e.g., brief explanations, justified contributions, counterarguments, non-argumentative reply) and their impact on the students' achievement.
- Interactive phase of knowledge (Engel and Onrubia, 2010; Hew Khe & Cheung Wing, 2011; Castellanos Ramírez and Niño Carrasco, 2018). From this approach, students' cognitive discourse is analyzed through four progressive stages of knowledge: task clarification/organization; exchange of initial information/ideas; production of personal ideas and development of final synthesis/agreements.

Within the same framework as the online learning models, the learning regulation theoretical construct has acquired greater importance in the last decade (Saab, Joolingen & Hout-Wolters, 2012; Schoor & Barnnert, 2012; Järvelä, Järvenoja, Malmberg & Hadwin, 2013; Kwon, Liu & Johnson, 2014; Lee, O'Donnell & Rogat, 2015; Malmberg, Järvelä, Järvenoja & Panadero, 2015; Miller & Hadwin, 2015; Panadero & Järvelä, 2015; Raes, Schellens, De Wever & Benoit, 2016; Borge, Ong & Rosé, 2018); for example, Garrison & Akyol (2013 and 2015) incorporated the learning regulation dimension within their research community model and situated the participants' metacognitive discourse at the intersection between the cognitive presence, teaching presence and social presence. Garrison & Akyol (2013) claim that "metacognition is a complex mix of cognitive presence and teaching presence elements but is also mediated by social presence as well as entering self-efficacy and motivational beliefs" (p. 86).

As for the empirical study of the regulation processes, we note a greater development over the last five years; hence, we can say that it is a relatively young field of knowledge in comparison with the research centered on the study of the construction of shared knowledge. In fact, the study of regulation on online collaborative environments has been addressed in an exploratory manner and, different papers have presented interesting results; e.g., different types of collaborative learning regulation have been observed such as self-regulation, hetero-regulation and socially shared regulation (Panadero & Järvelä, 2015; Schoor, Narciss & Korndel, 2015). Several functions or regulatory phases such as planning, monitoring and evaluation have been observed (Lee et al., 2015; Castellanos Ramírez & Onrubia, 2018); or, several domain areas such as the metacognitive, metasocial and metamotivational domains (Kwon, Liu & Johnson, 2014; Malmberg et al., 2015; Järvelä, Malmberg & Koivuniemi, 2016).

However, most of the regulation processes observed in previous papers have been analyzed disregarding the cognitive activity developed by students and, furthermore, "researchers have not fully explored how these regulated learning processes occur in temporal and sequential order and how they fuel knowledge construction" (Malmberg, Järvelä & Jarvenoja, 2017; p.161).

Since the two lines of research (construction of shared knowledge and learning regulation) have been addressed independently, this paper will aim at addressing both lines simultaneously and thus obtaining a more comprehensive interpretation of the online collaborative processes. This entails serious methodological considerations, among which being able to distinguish between the discursive strategies used by students to construct knowledge and the strategies to regulate and maintain the good functioning of the group. More specifically, this work is driven by the following three questions:

- What discursive strategies do students use to construct knowledge and which one do they used to regulate their collaborative activity?
- How does the students' cognitive and regulatory discourse evolve throughout the collaborative task?
- How does learning regulation come into play in the construction of the shared knowledge processes?

## **METHODOLOGY**

The methodological approach adopted for this research is framed within the interpretative paradigm proposed by Erikson (1986). This approach has made it possible to address in depth the interaction developed by the students in asynchronous communication forums.

Through a multiple case study (Flick, 2002; Yin, 2006), we analyze the collaborative processes developed by six groups of students enrolled in the bachelor's degree in educational sciences at the Universidad Autónoma de Baja California [Baja California Autonomous University], Mexico.

### **Participants and Observation Situations**

This study involved 30 students enrolled in the blended modality research methodology course. Every student had previous experience in using the LMS Blackboard platform. Students were randomly grouped in teams of five participants to work in collaboration in addressing a problem and its theoretical delimitation.

Prior to beginning the activity, the professor explained the general characteristics of the task to the students and provided the groups with a series of guiding questions: What is the theoretical and empirical interest in selected problem? Where does the problem arise or occur? Who are the persons involved? What are their characteristics? What objectives drive addressing the problem? And, what are the theoretical and conceptual coordinates that define the problem? For four weeks, the students held conversations through an asynchronous communication forum to solve the task and, at the end of this period they handed in a written report of the task to their professor.

### **Procedure of data collection and analysis**

The data analyzed correspond to the contributions of the groups of students within the asynchronous communication forums. In order not to affect the natural development of the students' collaborative process, researchers accessed the asynchronous forums once the groups had completed the task. A total of 638 contributions were collected and distributed as follows: group 1 (Gr1), 114 contributions; Group 2 (Gr2), 112;

Group 3 (Gr3) 97; Group 4 (Gr4, 86; Group 5 (Gr5), 108; and Group 6 (Gr6), 121.

In accordance with the objectives set out in this study, the first level of analysis consisted in identifying the interaction segments (IS). As defined in previous papers (Coll, De Gispert and Rochera, 2010; Valdebenito and Duran, 2015), an IS is the basic unit of analysis that allows the researcher to contextualize the contributions and the sense of students' contribution within the broadest framework of the collaborative process. An IS is integrated in a set of contributions made by several members of the group; the starting point of an IS is identified by a message that triggers a sequence of contributions linked to an actual specific thematic axis and, at the end of the chain, it is recognized by the turn that closes the thematic axis in question and concludes the dialogue reciprocity. The ISs were identified according to the following procedure:

- We registered the information generated in asynchronous forums in different ad hoc templates developed in Excel. In these templates, students' contributions were organized in a chronological order.
- The contributions were fragmented into small thematic units with their own meaning. In general, within a contribution, we identified one or several thematic units bearing meaning.
- Message fragments were organized by thematic axis and from these, we reconstructed the students' dialogue in IS. In order to discern which message fragments make up an IS, we use three criteria: connectivity by thematic adjacency, when we observed a conversational reciprocity between two message fragments referring to the same topic and belonging to continuous messages in time; connectivity by allusion, when the content of a message fragment alluded to a peer or attached document that gave conversational continuity to a topic previously raised; and, connectivity by implicit continuity, when within the content of a message fragment there was an implicit response to a conversational line that had been previously raised and retaken or concluded the discussion on a specific topic.

The second level of analysis consisted in analyzing the cognitive and regulatory discourse used by students during their collaboration. Through a back-and-forth iterative process, we constructed the codes and criteria to do research on ISs. Table 1 shows the set of codes developed for the analysis of the cognitive discourse.



**Table 1.** Protocol for the cognitive discourse coding

Foco de análisis	Códigos	Descripción
Construcción del conocimiento (CR_c)	C_1	Aportan ideas propias
	C_2	Reformulan los significados presentados con anterioridad
	C_3	Solicitan aclaraciones o precisiones sobre las ideas aportadas
	C_4	Manifiestan acuerdos sobre las ideas aportadas
	C_5	Manifiestan desacuerdos sobre las ideas aportadas
	C_6	Repiten de manera literal las aportaciones de sus compañeros
	C_7	Amplían las ideas anteriores
	C_8	Incorporan fuentes de información
	C_9	Relacionan ideas o aportaciones de distintos compañeros
	C_10	Sintetizan la información

Source: Self development.

Alongside, we applied a second protocol aiming at identifying the regulatory strategies used by students in ISs. Table 2 contains the description of the codes used to this effect.

**Table 2.** Protocol for the codification of regulatory strategies

Foco de análisis	Códigos	Descripción
Regulación del aprendizaje (RG_t)	R_1	Establecen objetivos o metas para la tarea
	R_2	Formulan procedimientos para abordar la tarea
	R_3	Interpretan las pautas de la tarea para orientar sus acciones
	R_4	Monitorean el progreso de la tarea
	R_5	Solicitan la atención o participación de sus compañeros
	R_6	Organizan roles y funciones para el abordaje de la tarea
	R_7	Inhiben malos comportamientos dentro del grupo
	R_8	Confirman la dirección de la tarea
	R_9	Comparten expectativas positivas sobre la tarea
	R_10	Transmiten apoyo socioemocional

Source: Self development.

## RELIABILITY CONTROL

Two researchers with previous experience in the topic/object of study participated in developing the protocols. For four weeks, said researchers gathered to examine the data and construct the coding system of the contributions.

In order to achieve greater reliability of the analysis, after the researchers ended the coding protocols, we instructed two independent assessors to carry out in a more objective manner the coding of the material. Relying on the Atlas.Ti program, the independent assessors separately coded the content of the ISs and, at the end of the analyses, they gathered to weigh and discuss the results. A consensus between the assessors was reached in more than 80% of the codes assigned, and a third judge (main researcher) intervened in a small part of the coding to solve the doubts raised by the assessors.

## RESULTS

### Identification of Interaction Segments and Contribution Density

Table 3 shows the frequency of the IS identified in the groups as well as the density they have according to the average of contributions that makes them up. These data are organized in relation with the four-week period that lasted the collaborative task. In all the six groups analyzed, 111 ISs were identified, most of the ISs were observed in groups Gr2 (21 ISs) and group Gr6 (20 ISs), and they appeared with greater frequency during the first two weeks of participation in the forum. In the other groups (Gr1, Gr3, Gr4 and Gr5) we identified a lesser proportion of ISs (between 17 and 18 ISs); in regard to Gr1 and Gr3, the ISs emerged more regularly in the first two weeks of activity, while in Gr4 and Gr5, ISs were more consistent during the last two weeks of activity. This result underscores the fact that while some groups of students work intensively in the early stages of the task, other are less active at the beginning of the task and wait until the last weeks to get more involved in their work.

Likewise, we observe that, on average, the Gr4 and Gr5 have six contributions per Is in comparison with the other groups that showed between eight and eleven contributions. Although Gr4 and Gr5 presented the highest IS frequency in the last two weeks of activity, the average contributions always remained below the other groups.

**Table 3.** Interaction segments identified and contribution average that makes them up

Grupos	Semana 1		Semana 2		Semana 3		Semana 4		Total	
	<i>f</i>	$\bar{X}$	<i>f</i>	$\bar{X}$	<i>f</i>	$\bar{X}$	<i>f</i>	$\bar{X}$	<i>f</i>	$\bar{X}$
Gr1	5	8	5	11	4	9	3	11	17	10
Gr2	6	7	6	10	5	10	4	10	21	9
Gr3	5	7	6	10	4	8	3	8	18	8

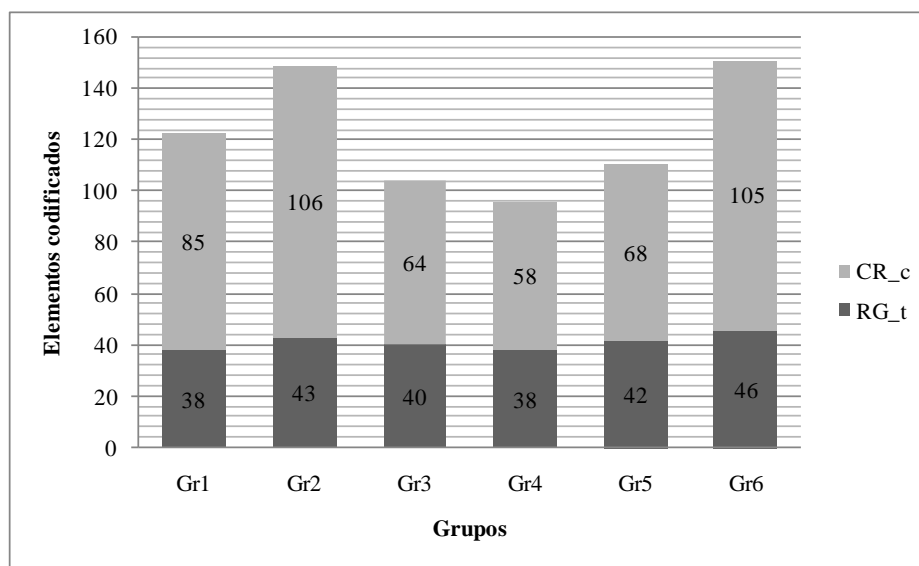


Gr4	2	6	3	6	6	5	6	6	17	6
Gr5	2	7	2	7	7	6	7	6	18	6
Gr6	5	12	7	11	4	10	4	10	20	11

Source: Self development.

### Analysis of Interaction Segments

In the set of ISs identified, we encoded 733 meaning units of which 66% correspond to the discursive strategies used to construct knowledge and 34% to the task regulatory strategies. Figure 2 shows the results obtained from the IS analysis according the categories laid for each group of students. In Gr1, Gr2 and Gr6, we observe a predominant frequency of discourse aiming at the discussion of meanings to the detriment of the use of regulatory strategies. On the one hand, in Gr3, Gr4 and Gr5, the regulatory and the cognitive discourses are presented in a more balanced manner. It is important to highlight that the regulatory actions do not appear prevalently in none of the groups analyzed.



**Figure 2.** Frequencies of the cognitive and regulatory discourse set for the groups.

Table 4 contains the results corresponding to the analysis of cognitive discursive strategies. Globally, Gr2 (106 codified elements) and Gr6 (105 codified elements) are the groups that showed greater cognitive activity; in these, the discourse of the students is characterized, mainly, by the development of personal ideas (C\_1), the relation of ideas (C\_9) and the capacity of synthesis of the students of the information provided (C\_10). Gr1 showed a strong quantity of requests for clarification of the topics (C\_3 with fourteen codified elements), contribution with personal ideas (C\_1

with thirteen codified elements), reformulation of meanings (C\_2 with twelve codified elements) and the relation of ideas (C\_9 with eleven codified elements). As for groups Gr3, Gr4 and Gr5, we observed a constant literal repetition of ideas (C\_6), in detriment of the formulation of personal ideas (C\_1).

**Table 4.** Discursive strategies used by the groups for the construction of knowledge

Códigos	Gr1	Gr2	Gr3	Gr4	Gr5	Gr6	Total
	<i>f</i>	<i>f</i>	<i>F</i>	<i>f</i>	<i>f</i>	<i>F</i>	
C_1	13	20	12	9	10	18	82
C_2	12	9	6	5	6	14	52
C_3	14	8	6	6	6	19	59
C_4	7	9	11	10	7	7	51
C_5	3	2	3	2	3	4	17
C_6	4	10	14	12	18	6	64
C_7	6	11	3	3	4	7	34
C_8	6	7	6	7	6	5	37
C_9	11	16	3	2	4	14	50
C_10	9	14	2	2	4	11	42
Total	85	106	66	58	68	105	488

Source: Self development.

Table 5 shows the results obtained from the analysis of the ISs in relation to the task regulatory category for each group. Gr2 and Gr6 are the groups that used a greater quantity of regulatory resources, that highlight a strong monitoring of the task progress (R\_4), that establish objectives and goals (R\_1), that confirm the direction of the task (R\_8) and project positive expectations of the task (R\_9). On the one hand, groups Gr3, Gr4 and Gr5 constantly carry out confirmations on the direction of the task (R\_8) and the requests for the participation of peers (R\_5).

**Table 5.** Regulatory strategies used by the groups to control the task

Códigos	Gr1	Gr2	Gr3	Gr4	Gr5	Gr6	Total
	<i>f</i>	<i>f</i>	<i>F</i>	<i>f</i>	<i>f</i>	<i>f</i>	
R_1	7	8	3	3	7	7	35
R_2	2	1	3	3	3	2	14
R_3	5	3	4	5	5	2	24
R_4	9	10	7	3	4	9	42
R_5	0	1	6	7	5	3	22
R_6	1	3	3	4	4	2	17
R_7	0	0	1	2	3	1	7
R_8	3	7	10	7	7	9	43
R_9	5	7	0	2	3	6	23
R_10	6	3	3	2	1	5	20
Total	38	43	40	38	42	46	247

Source: Self development.

Table 6 shows the most representative discursive mechanisms (construction of knowledge and learning regulation) in the groups according to the different weeks of activity in the forums. The mechanisms that do not play a prevalent role in the weekly activity of the students have been omitted from this table.

In group GR1, the cognitive discourse of the participants clearly points out toward an efficient and progressive construction of knowledge. In this group, the students contributed with a great quantity of personal ideas during the first week of activities. In the second week, a critical analysis of ideas expressed was conducted to seek clarification and to reformulate meanings. In the third week, a shared content framework was defined through the expansion of ideas, relations between meanings and incorporation of new sources of information. In the last week, final agreements were synthesized and reached regarding the content of the products developed. Regarding the regulatory mechanisms, this group stands out by showing, in the first week of activities, a discourse directed to setting objectives and goals, the formulation of positive expectations and the interpretation of guidelines of the task, while in the following weeks, we observe a constant monitoring of the task progress.

The students in Gr2 and Gr6 facilitated immediately a constructive dialogue; i.e., from the first two weeks of activity in the forum, the students participated in a rich and constructive discourse, contributed with personal ideas, expanded concepts, related meanings, and agreed on the topics discussed. The regulatory strategies most frequently used in the first week of activities correspond to the formulation of the task positive expectations and the confirmations on the direction of the task, while in the following weeks, in the same way as for Gr1, there was a constant monitoring of the task progress.

Lastly, we did not observe any complex cognitive activities in groups Gr3, Gr4 and Gr5 since most of their collaboration focused on the accumulation and repetition of ideas with very little evidence of transformation/deepening of the meanings provided. As for the regulatory processes, we can highlight that the monitoring of the task was not a recurrent strategy in these groups during the first three weeks. Likewise, the interpretation of the task guidelines and the participation requests in the advanced stage of the task, reflect difficulties within the group related to the lack of involvement of the students and the ambiguities in understanding the initial demand made by the teacher regarding the drafting of the final report. On the one hand, the regulation exercise was limited to the confirmation of the direction of the task without implying a systematic monitoring of the progress, achievement or pending issues.

**Table 6.** Predominance and temporary development of the cognitive and regulatory discourse in the groups

Grupo s	Estrategi as	Semana 1	Semana 2	Semana 3	Semana 4
Gr1	CR_c	<ul style="list-style-type: none"> <li>• Aportan ideas propias (C_1)</li> </ul>	<ul style="list-style-type: none"> <li>• Solicitan aclaraciones sobre los temas (C_3)</li> <li>• Reformulan significado s (C_2)</li> </ul>	<ul style="list-style-type: none"> <li>• Relacionan ideas (C_9)</li> <li>• Incorporan fuentes de información (C_8)</li> <li>• Amplían las ideas anteriores (C_7)</li> </ul>	<ul style="list-style-type: none"> <li>• Sintetizan la informaci ón (C_10)</li> <li>• Manifiestan acuerdos (C_4)</li> </ul>
	RG_t	<ul style="list-style-type: none"> <li>• Establecen objetivos/me tas (R_1)</li> <li>• Formulan expectativas positivas sobre la tarea (R_9)</li> <li>• Interpretan las pautas de la tarea (R_3)</li> </ul>	<ul style="list-style-type: none"> <li>• Monitorea n el progreso de la tarea (R_4)</li> <li>• Confirman la dirección de la tarea (R_8)</li> </ul>	<ul style="list-style-type: none"> <li>• Monitorean el progreso de la tarea (R_4)</li> <li>• Se brindan apoyo socioemocio nal (R_10)</li> </ul>	<ul style="list-style-type: none"> <li>• Monitorean el progreso de la tarea (R_4)</li> </ul>

	CR_c	<ul style="list-style-type: none"> <li>• Aportan ideas propias (C_1)</li> <li>• Amplían las ideas anteriores (C_7)</li> </ul>	<ul style="list-style-type: none"> <li>• Aportan ideas propias (C_1)</li> <li>• Relacionan ideas (C_9)</li> <li>• Incorporan fuentes de información (C_8)</li> <li>• Manifiestan acuerdos (C_4)</li> </ul>	<ul style="list-style-type: none"> <li>• Aportan ideas propias (C_1)</li> <li>• Relacionan ideas (C_9)</li> <li>• Sintetizan la información (C_10)</li> <li>• Incorporan fuentes de información (C_8)</li> </ul>	<ul style="list-style-type: none"> <li>• Sintetizan la información (C_10)</li> <li>• Manifiestan acuerdos (C_4)</li> </ul>
Gr2					
Gr6	RG_t	<ul style="list-style-type: none"> <li>• Formulan expectativas positivas sobre la tarea (R_9)</li> <li>• Confirman la dirección de la tarea (R_8)</li> </ul>	<ul style="list-style-type: none"> <li>• Monitorean el progreso de la tarea (R_4)</li> </ul>	<ul style="list-style-type: none"> <li>• Monitorean el progreso de la tarea (R_4)</li> <li>• Confirman la dirección de la tarea (R_8)</li> </ul>	<ul style="list-style-type: none"> <li>• Monitorean el progreso de la tarea (R_4)</li> <li>• Confirman la dirección de la tarea (R_8)</li> <li>• Formulan expectativas positivas sobre la tarea (R_9)</li> </ul>
	CR_c	<ul style="list-style-type: none"> <li>• Aportan ideas propias (C_1)</li> <li>• Incorporan fuentes de información (C_8)</li> </ul>	<ul style="list-style-type: none"> <li>• Repiten de manera literal las aportaciones anteriores (C_6)</li> <li>• Aportan ideas propias (C_1)</li> </ul>	<ul style="list-style-type: none"> <li>• Repiten de manera literal las aportaciones anteriores (C_6)</li> </ul>	<ul style="list-style-type: none"> <li>• Manifiestan acuerdos (C_4)</li> </ul>
Gr3					
Gr4				<ul style="list-style-type: none"> <li>• Confirman la dirección de la tarea (R_8)</li> </ul>	
Gr5	RG_t	<ul style="list-style-type: none"> <li>• Confirman la dirección de la tarea (R_8)</li> </ul>	<ul style="list-style-type: none"> <li>• Confirman la dirección de la tarea (R_8)</li> </ul>	<ul style="list-style-type: none"> <li>• Solicitan la participación de sus compañeros (R_5)</li> <li>• Interpretan las pautas de la tarea (R_3)</li> </ul>	<ul style="list-style-type: none"> <li>• Monitorean el progreso de la tarea (R_4)</li> </ul>

Source: Self development.

## DISCUSSION

Kwon, Liu & Johnson (2014), Malmberg et al. (2015), Raes et al. (2016) and Borge, Ong & Rosé (2018) have formulated the hypothesis on the importance the regulatory processes have in the collaborative framework to sustain the deep processes of the construction of shared knowledge since “learning how to regulate cognition at the level of the group can enhance the quality of collective thinking and help the group to improve and adapt over time” (Borge, Ong & Rosé, 2018, p. 28). However, at the empirical level, this aspect has been little delved into; hence, there is still much unknown on the effect that the regulatory discourse may have on the knowledge constructed by the students, since it has been inferred mainly by the students’ levels of achievement in the academic task (Saab et al., 2012; Järvelä et al., 2013; Kwon, Liu & Johnson, 2014; Malmberg, et al., 2015), and not by the nature of the cognitive discourse developed by the students during the collaborative process. Along these lines, we consider that an important limitation of the research conducted on the online collaborative learning lies in the explanation made about the regulatory discourse in comparison with the processes of construction of shared knowledge. As Garrison & Akyol (2015) claim:

Only when we integrate cognitive and teaching presence do we fully appreciate and realize the importance of both self and co-regulation [...]. Therefore, from a metacognitive perspective it would be a mistake to focus exclusively on self-regulation. More importantly, it would violate the basic premise of the CoI framework (p. 85).

In this context, the main purpose of our work consisted in establishing two lines of research (construction of shared knowledge and learning regulation) which, until now, had been developed separately, and address them empirically as interdependent processes. In this regard, we have realized that in asynchronous collaborative tasks, it is possible to identify in parallel both discursive strategies aiming at the construction of domain knowledge on the task contents (cognitive discourse) and the strategies oriented to the regulation of group learning (regulatory discourse).

At the empirical level, our work highlights an important relation between the regulatory strategies used by students to control the task and the quality of the cognitive discourse directed to the construction of knowledge. Setting goals, formulating positive expectations about the task, monitoring progress and socio-emotional support, are regulatory mechanisms that strongly contribute to developing deep processes of knowledge construction, as observed in groups Gr1, Gr2 and Gr6. More specifically, we infer that those regulatory strategies support the development of a dense and complex cognitive discourse, e.g., the development of personal ideas, the relations between meanings, clarification requests, reformulation of ideas and development of conceptual syntheses.



We believe that the foregoing findings expand the previous works of Saab et al. (2012), Lee et al. (2015) and Malmberg et al. (2015), who underline the positive relations between the regulatory processes and the levels of performance achieved by the groups, however, in our case, the regulation of learning is associated to typologies of cognitive discourse used by the students to co-construct knowledge.

Likewise, in agreement with the previous works of Rogat and Linnenbrink (2011), Järvelä et al. (2013), Kwon, Liu & Johnson (2014) and Malmberg et al. (2015), we highlight a positive synergy between the socio-emotional support participants provide one another, the regulation exercised on the task and the quality of the cognitive discourse. We also believe that the formulation of positive expectations on the academic task is an important regulatory strategy that contributes to achieving deep processes of construction of shared knowledge; these findings are in line with those propounded by Colomina & Remesal (2015), who conducted a research on the social presence in an online collaborative environment and showed that positive expectations – conceived as a feeling of group self-competence – significantly support the development of the cognitive presence in the group.

As for the analysis of the temporary evolution of the cognitive and regulatory discourse of the groups, we identified three patterns of different collaboration. The first (developed by the GR1 group) consist in the systematic and progressive development of knowledge throughout the weeks, supported by setting goals, formulating expectations and interpreting the task guidelines at the early stages of the activity and monitoring constantly the collaborative process. The second (developed by groups G2 and G6) consists in rapid and deep development of knowledge that occurs from the beginning of the activity which is also characterized by the positive expectations about the task and the steady monitoring of the collaborative process by the students. The third pattern (developed by groups Gr3, Gr4 and Gr5) tries to carry out superficial/simple cognitive processes about the task content, with little evolution of knowledge and a scarce monitoring of the collaborative process.

As for the previous point, we believe that even though there are previous studies that explore the temporary evolution of the students' cognitive discourse, the temporary evolution had not been explored in the regulatory processes. Along these lines, the results of this work highlight two contribution of interest. On the one hand, we emphasize that the formulation of expectations in the early stages of the task contributes to the good operation of the groups and the subsequent development of the task. On the other hand, and in agreement with Schoor & Barnnert (2012), we stress that the steady monitoring of the task and the construction of ideas on the thematic contents go hand in hand and influence one another.

## CONCLUSION

In the society of information, one of the purposes of higher education is that the students develop technological competences and skills for teamwork. In this regard, universities have gradually implemented LMS platforms to support students' learning and, more specifically, it has created a strong interest in promoting the development of collaborative tasks through electronic means of asynchronous communication. As a result of these pedagogical proposals, several research studies have been conducted to explore the inter-psychological mechanisms that occur in those environments and that promote deep processes of construction of shared knowledge. Beyond recognizing the importance of the discourse aiming at the construction of shared knowledge, this paper focused on exploring the collaborative process from a twofold standpoint: the cognitive discourse and the regulatory discourse. Based on these findings, we conclude with three aspects of interest.

- In asynchronous collaboration, students use different discursive strategies to regulate learning that addresses the control of the collaborative control on three different planes: task, participation and socio-emotional context. It emphasizes, more specifically that the formulation of expectations, the monitoring of the task and the socio-emotional support are strategies that contribute to the efficient development of the students' collaboration. Regarding this point, we consider that one of the limitations of our work has to do with the fact that we have not incorporated more specific categories in the coding; e.g., when talking about the task expectations, we did not make the distinction whether we are dealing with personal expectations (personal), group expectations (shared) or expectations placed on another participant. In this sense, an open line for future research consists in distinguishing within each one of the regulatory discursive mechanisms, the regulation modalities referring to those mechanisms and that, according to Miller & Hadwin (2015) and Panadero and Järvelä (2015), could be associated to different types of regulation (self-regulation, guided regulation or shared regulation).
- The learning regulatory processes are associated to a greater development of personal ideas, relations between meanings, and clarification requests about the meanings, reformulation of ideas and the development of conceptual syntheses. While our work offers a first approximation about these aspects, the results must be treated with caution given the low number of cases analyzed. On the one hand, we consider that it is important to continue delving into this line of studies and raising the possibility that future research can strengthen the relations between different types of regulatory and cognitive discourses through correlation statistical tests.
- Lastly, regarding the temporary breakdown of the discourses analyzed, we infer that in order to develop a dense and deep cognitive discourse

about the thematic contents, the presence of positive expectations and the setting of goals about the task at an early stage of the collaborative process as well as the presence of a steady monitoring of the task are necessary. In the future, the temporary analysis of the types of discourse could be enriched through the use of data mining to identify temporary patterns and sequences between different types of regulatory and cognitive discourses as it has been done in previous studies (Schoor & Barnnert, 2012; Malmberg et al., 2015).

Some practical implications arising from our work address the relevance of intervening in instructional terms in two different instances. First, before beginning addressing the task directly by developing instructional guidelines aiming at the students sharing their personal and group expectations, besides having the possibility to set short-and-medium term goals to develop the task efficiently. Second, while developing the task, we request the students to hand in reports on their progress on a regular basis in order to have a greater impact on the groups monitoring their activities.

ANUIES. (2015). *Fortalecer el Sistema Nacional de Educación Superior a Distancia, el objetivo: ANUIES*. Recuperado de: <http://www.anui.es.mx/secretaria-general/fortalecer-sistema-nacional-de-educacin-superior-a-distancia-el>

Bliuc, Ana María; Ellis, Robert; Goodyear, Peter & Piggott, Leanne. (2011). A blended learning approach to teaching foreign policy: Student experiences of learning through face-to-face and online discussion and their relationship to academic performance. *Computers in Education*, 56(3), pp. 856-864. <https://doi.org/10.1016/j.compedu.2010.10.027>

Borge, Marcela; Ong, Yann & Rosé, Carolyn. (2018). Learning to monitor and regulate collective thinking processes. *International Journal of Computer-Supported Collaborative Learning*, 13(1), pp. 61-92. <https://doi.org/10.1007/s11412-018-9270-5>

Brun, Mario & Hinostroza, Enrique. (2014). Learning to become a teacher in the 21st century: ICT integration in Initial Teacher Education in Chile. *Educational Technology & Society*, 17(3), pp. 222-238. Recuperado de: [https://www.j-ets.net/ets/journals/17\\_3/17.pdf](https://www.j-ets.net/ets/journals/17_3/17.pdf)

Campos Cruz, Héctor y Ramírez Sánchez, Miguel Ysrrael. (2018). Las TIC en los procesos educativos de un centro público de investigación. *Apertura*, 10(1), pp. 56-70. <http://dx.doi.org/10.32870/Ap.v10n1.1160>

Castellanos Ramírez, Juan y Niño Carrasco, Shamaly. (2018). Aprendizaje colaborativo y fases de construcción compartida del conocimiento en entornos tecnológicos de comunicación asíncrona. *Innovación Educativa*, 18(76), pp. 69-88. Recuperado de: [http://www.scielo.org.mx/scielo.php?script=sci\\_arttext&pid=S1665-26732018000100069&lng=es&tlng=es](http://www.scielo.org.mx/scielo.php?script=sci_arttext&pid=S1665-26732018000100069&lng=es&tlng=es)

Castellanos Ramírez, Juan & Onrubia, Javier. (2018). Group characteristics and profiles of shared regulation in collaborative environments involving asynchronous communication. *Infancia y Aprendizaje*, 41(2), pp. 369-414. <https://doi.org/10.1080/02103702.2018.1434037>

Castro Méndez, Nelson; Suárez Cretton, Ximena y Soto Espinoza, Víctor. (2016). El uso del foro virtual para desarrollar el aprendizaje autorregulado de los estudiantes universitarios. *Innovación Educativa*, 16(70), pp. 23-41. Recuperado de: <http://www.redalyc.org/articulo.oa?id=179445403002>

- Clark, Douglas & Sampson, Victor. (2008). Assessing dialogic argumentation in online environments to release structure, grounds, and conceptual quality. *Journal of Research in Science Teaching*, 45(3), pp. 293-321. <https://doi.org/10.1002/tea.20216>
- Coll, César & Engel, Anna. (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 / Annals of Psychology*, 30(3), pp. 818-831. <https://doi.org/10.6018/analesps.30.3.201181>
- Coll, César; De Gispert, Inés y Rochera, María José. (2010). Tópicos y cadenas: una aproximación al análisis de la construcción conjunta de significados en foros de conversación en línea. *Cultura y Educación*, 22(4), pp. 439-454. <https://doi.org/10.1174/113564010793351885>
- Colomina, Rosa & Remesal, Ana. (2015). Social presence and virtual collaborative learning processes in higher education. *Infancia y Aprendizaje*, 38(3), pp. 647-680. <https://doi.org/10.1080/02103702.2015.1054664>.
- Conde Gonzáles, Miguel; García Peñalvo, Francisco José; Rodríguez Conde, María José; Alier Forment, Marc; Casany, María José & Piguillem Poch, Jordi. (2014). An evolving Learning Management System for new educational environments using 2.0 tools. *Interactive Learning Environments*, 22(2), pp. 188-204. <https://doi.org/10.1080/10494820.2012.745433>
- De Oliveira, Paulo; Cunha, Cristiano & Nakayama, Marina. (2016). Learning management systems (LMS) and e-learning management: an integrative review and research agenda. *Journal Of Information Systems And Technology Management*, 13(2), pp. 157-180. <http://dx.doi.org/10.4301/S1807-17752016000200001>
- Engel, Anna y Onrubia, Javier (2010). Patrones de organización grupal y fases de construcción del conocimiento en entornos virtuales de aprendizaje colaborativo. *Infancia y Aprendizaje*, 33(4), pp. 515-528. <https://doi.org/10.1174/021037010793139608>
- Erickson, Frederick. (1986). Qualitative methods in research of teaching, en M. Wittrock (ed.), *Handbook of research on teaching* (pp. 119-161). Nueva York: Macmillan.
- Flick, Uwe. (2002). Qualitative Research-State of the Art. *Social Science Information*, 4(1). <https://doi.org/10.1177/053901840204100101>

- Garrison, Randy & Akyol, Zehra. (2013). Toward the development of a metacognition construct for communities of inquiry. *The Internet and Higher Education*, 17(2), pp. 84-89. <https://doi.org/10.1016/j.iheduc.2012.11.005>
- Garrison, Randy & Akyol, Zehra. (2015). Thinking collaboratively in shared educational environments: Shared metacognition and co-regulation in communities of inquiry, en J. Lock, P. Redmond & P. Danaher (eds.), *Educational developments, practices and effectiveness* (pp. 39-52). Nueva York, NY: Palgrave Macmillan.
- Hamada, Mohamed & Hassan, Mohamed. (2017). An Interactive Learning Environment for Information and Communication Theory. *Eurasia Journal of Mathematics, Science & Technology Education*, 13(1), pp. 35-59. <https://doi.org/10.12973/eurasia.2017.00603a>
- Hew Khe, Foon & Cheung Wing, Sum. (2011). Higher-level knowledge construction in asynchronous online discussions: An analysis of group size, duration of online discussion, and student facilitation techniques. *Instructional Science*, 39(3), pp. 303-319. <https://doi.org/10.1007/s11251-010-9129-2>
- Järvelä, Sanna & Hadwin, Allyson. (2013). New Frontiers: Regulating Learning in CSCL. *Educational Psychologist*, 48(1), pp. 25-39. <https://doi.org/10.1080/00461520.2012.748006>
- Järvelä, Sanna; Järvenoja, Hanna; Malmberg, Jonna & Hadwin, Allyson. (2013). Exploring socially-shared regulation in the context of collaboration. *Journal of Cognitive Education and Psychology*, 12(3), pp. 267-286. <http://dx.doi.org/10.1891/1945-8959.12.3.267>
- Järvelä, Sanna; Malmberg, Jonna & Koivuniemi, Marika. (2016). Recognizing socially shared regulation by using the temporal sequences of online chat and logs in CSCL. *Learning and Instruction*, 42(1), pp. 1-11. <https://doi.org/10.1016/j.learninstruc.2015.10.006>
- Johnson, Cass (2016). Rethinking online discourse: Improving learning through discussions in the online classroom. *Education and Information Technologies*, 21(6), pp. 1483-1507. <https://doi.org/10.1007/s10639-015-9395-3>
- Koivuniemi, Marika; Panadero, Ernesto; Malmberg, Jonna y Järvelä, Sanna. (2017). Desafíos de aprendizaje y habilidades de regulación en distintas situaciones de aprendizaje en estudiantes de educación superior. *Infancia y Aprendizaje*, 40(1), pp. 19-55. <https://doi.org/10.1080/02103702.2016.1272874>



- Kwon, Kyungbin; Liu, Ying-Hsiu & Johnson, Lashaune. (2014). Group regulation and social-emotional interactions observed in computer supported collaborative learning: Comparison between good vs. poor collaborators. *Computers & Education*, 78(9), pp. 185-200. <https://doi.org/10.1016/j.compedu.2014.06.004>
- Lee, Anna; O'Donnell, Angela & Rogat, Toni. (2015). Exploration of the cognitive regulatory sub-processes employed by groups characterized by socially shared and other-regulation in a CSCL context. *Computers in Human Behavior*, 52(11), pp. 617-627. <https://doi.org/10.1016/j.chb.2014.11.072>
- Lloréns Báez, Luis; Espinosa Díaz, Yessica y Castro Murillo, María. (2013). Criterios de un modelo de diseño instruccional y competencia docente para la educación superior escolarizada a distancia apoyada en TICC. *Sinéctica, Revista Electrónica de Educación*, 41(2), pp. 1-21. Recuperado de: <https://sinectica.iteso.mx/index.php/SINECTICA/article/view/35/841>
- Malmberg, Jonna; Järvelä, Sanna & Järvenoja, Hanna. (2017). Capturing temporal and sequential patterns of self-, co-, and socially shared regulation in the context of collaborative learning. *Contemporary Educational Psychology*, 49(2), pp. 160-174. <https://doi.org/10.1016/j.cedpsych.2017.01.009>
- Malmberg, Jonna; Järvelä, Sanna; Järvenoja, Hanna & Panadero, Ernesto. (2015). Promoting socially shared regulation of learning in CSCL: Progress of socially shared regulation among high- and low-performing groups. *Computers in Human Behavior*, 52(11), pp. 562-572. <https://doi.org/10.1016/j.chb.2015.03.082>
- Mayordomo, Rosa & Onrubia, Javier. (2015). Work coordination and collaborative knowledge construction in a small group collaborative virtual task. *The Internet and Higher Education*, 25, pp. 96-104. <https://doi.org/10.1016/j.iheduc.2015.02.003>
- Miller, Mariel & Hadwin, Allyson. (2015). Scripting and awareness tools for regulating collaborative learning: Changing the landscape of support in CSCL. *Computers in Human Behavior*, 52(12), pp. 573-588. <https://doi.org/10.1016/j.chb.2015.01.050>
- Oztok, Murat; Zingaro, Daniel; Brett, Clare & Hewitt, Jim. (2013). Exploring asynchronous and synchronous tool use in online courses. *Computers & Education*, 60(1), pp. 87-94. <https://doi.org/10.1016/j.compedu.2012.08.007>

- Panadero, Ernesto & Järvelä, Sanna. (2015). Socially Shared Regulation of Learning: A Review. *European Psychologist*, 20(3), pp. 190-203. <http://dx.doi.org/10.1027/1016-9040/a000226>
- Puntambekar, Sadhana. (2006). Analyzing collaborative interactions: Divergence, shared understanding and construction of knowledge. *Computers & Education*, 47(3), pp. 332-351. <https://doi.org/10.1016/j.compedu.2004.10.012>
- Raes, Annelies; Schellens, Tammy; De Wever, Bram & Benoit, Dries. (2016). Promoting metacognitive regulation through collaborative problem solving on the web: When scripting does not work. *Computers in Human Behavior*, 58(5), pp. 325-342. <https://doi.org/10.1016/j.chb.2015.12.064>
- Rogat, Toni & Linnenbrink, Lisa. (2011). Socially shared regulation in collaborative groups: an analysis of the interplay between quality of social regulation and group processes. *Cognition and Instruction*, 29(4), pp. 375-415. <https://doi.org/10.1080/07370008.2011.607930>
- Saab, Nadira; Joolingen, Wouter & Hout-Wolters, Bernadette. (2012). Support of the collaborative inquiry learning process: Influence of support on task and team regulation. *Metacognition and Learning*, 7(1), pp. 7-23. <http://dx.doi.org/10.1007/s11409-011-9068-6>
- Schoor, Cornelia & Bannert, María (2012). Exploring regulatory processes during a computer-supported collaborative learning task using process mining. *Computers in Human Behavior*, 28(4), pp. 1321-1331. <https://doi.org/10.1016/j.chb.2012.02.016>
- Schoor, Cornelia; Narciss, Susanne & Korndle, Hermann. (2015). Regulation during cooperative and collaborative learning: A theory-based review of terms and concepts. *Educational Psychologist*, 50(2), pp. 97-119. <https://doi.org/10.1080/00461520.2015.1038540>
- Stegmann, Karsten; Weinberger, Armin & Fischer, Frank. (2007). Facilitating argumentative knowledge construction with computer supported collaboration scripts. *International Journal of Computer-Supported Collaborative Learning*, 2(4), pp. 421-447. <https://doi.org/10.1007/s11412-007-9028-y>
- Valdebenito, Vanessa y Durán, David. (2015). Formas de interacción implicadas en la promoción de estrategias de comprensión lectora a través de un programa de tutoría entre iguales. *Revista Latinoamericana de Psicología*, 47(2), pp. 75-85. <https://doi.org/10.1016/j.rlp.2014.07.001>

- Vega García, Rosario. (2005). La educación continua a distancia en México: transformaciones y retos. *Revista de la Educación Superior*, 34(133), pp. 79-86. Recuperado de [http://publicaciones.anuies.mx/pdfs/revista/Revista133\\_S5A1ES.pdf](http://publicaciones.anuies.mx/pdfs/revista/Revista133_S5A1ES.pdf)
- Weinberger, Armin; Stegmann, Kersten & Fischer, Frank. (2007). Knowledge convergence in collaborative learning: Concepts and assessment. *Learning and Instruction*, 17(4), pp. 416-426. <http://dx.doi.org/10.1016/j.learninstruc.2007.03.007>
- Yin, Robert. (2006). Case study methods, en J. L. Green, G. Camilli y P. Elmore (eds.), *Handbook of complementary methods in education research* (pp. 111-122). Mahwah, NJ: L. Erlbaum.
- Zhang, Jianwei; Hong, Huang-Yao; Scardamalia, Marlene; Teo, Chew Lee & Morley, Elizabeth. A. (2011). Sustaining knowledge building as a principle-based innovation at an elementary school. *Journal of the Learning Sciences*, 20(2), pp. 262-307. <https://doi.org/10.1080/10508406.2011.528317>
- Zheng, Lanqin. (2016). Analysis of socially shared regulation in CSCL, en Z. Shi & S. Yu (eds.), *Perspectives on rethinking and reforming education* (pp. 65-81). Singapore: Springer. <https://doi.org/10.1007/978-981-10-1972-2>

