

# Proposal of an Analytical Model on Collaborative Learning Articles Published in The Last Five Years

Propuesta de un modelo analítico de artículos de aprendizaje colaborativo a nivel universitario publicados en los últimos cinco años

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**Received:** 07/01/2023

**Reviewed:** 08/02/2023

**Accepted:** 08/31/2023

**Online:** 08/31/2023

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**Cited as:**

Cardoni, J. & Roselli, N. (2023). Proposal of an Analytical Model on Collaborative Learning Articles Published in The Last Five Years. *Propósitos y Representaciones*, 11(2), e1828. <https://doi.org/10.20511/pyr2023.v11n2.1828>

## Summary

Research on the bibliographic review studies on collaborative learning at the university level published in the last five years, allows to verify an absence of systematic comparative analysis of explicit and exhaustive analytical criteria that enables ordering of the different contributions. Precisely, the objective of this work was to establish a referential analytical model that allows a clear systematization of the corpus of articles recovered in the period 2018-2022. To meet this objective, a bibliographic search was carried out in the databases: SciELO, RedALyC, Eric and Dialnet. 71 studies were recovered. In the first part of the manuscript, this corpus of research was analyzed based on the constructed analytical criteria or variables. In the second part, the variables of the proposed model were analyzed inclusively. Based on this systematization, 12 studies were selected that can be considered paradigmatic of the variables and classificatory modalities. In conclusion, the proposed analytical model allowed us to detect the existing diversity in the articles published in the last five years. Despite this great variety of research, the ordering of the articles according to classifying criteria makes it possible to elucidate certain patterns. Research in the last five years study the interactions that occur in the collaboration process, certain conditions under which collaborative learning is more efficient, and the effectiveness of certain strategies to support students' interactional, regulatory, and metacognitive processes.

**Keywords:** Collaborative learning; Cooperative learning; Teamwork; Bibliographical review.

## Resumen

Una mirada de los artículos de revisión bibliográfica sobre el aprendizaje colaborativo a nivel universitario publicados en los últimos cinco años permite constatar una ausencia de análisis comparativo sistemático de criterios analíticos explícitos y exhaustivos que permitan ordenar dichos aportes. Precisamente, el objetivo del presente trabajo fue proponer un modelo analítico referencial que permita una clara sistematización del corpus de artículos recuperados en el periodo 2018-2022. Para cumplir con dicho objetivo, se realizó una búsqueda bibliográfica en las bases de datos SciELO, Redalyc, Eric y Dialnet. Se recuperaron 71 investigaciones. En la primera parte del manuscrito se analizó este corpus de investigaciones en función de los criterios analíticos construidos o variables. En la segunda parte, se analizaron de forma inclusiva las variables del modelo propuesto. En función de esta sistematización, se seleccionaron 12 artículos que pueden ser considerados paradigmáticos de dichas variables y modalidades clasificatorias. A modo de conclusión, el modelo analítico propuesto permitió detectar la diversidad existente en los artículos publicados en los últimos cinco años. A pesar de esta gran variedad de investigaciones, el ordenamiento de los artículos según criterios clasificadores posibilita dilucidar ciertos patrones. Se encontraron investigaciones que estudian las interacciones que se dan en el proceso de colaboración, ciertas condiciones bajo las cuales el aprendizaje colaborativo resulta más eficiente y la efectividad de determinadas estrategias para apoyar los procesos interaccionales, regulatorios y metacognitivos de los estudiantes.

**Palabras claves:** Aprendizaje colaborativo; Aprendizaje cooperativo; Trabajo en equipo; Revisión bibliográfica.

## INTRODUCTION

Collaborative learning, defined as a context in which learners negotiate meanings in order to jointly construct knowledge (Curay, 2022), is the result of a convergence of different theoretical approaches. Some of these include the Anglo-Saxon cooperative learning movement (Johnson & Johnson, 1999), the theory of sociocognitive conflict (Doise & Mugny, 1981; Perret-Clermont, 1984), the theory of intersubjectivity and situated learning (Cole, 1990; Rogoff, 1993; Wertsch, 1988) and the theory of distributed cognition (Hutchins, 1991; Salomon, 2001) (Roselli, 2016a).

Cooperative learning theory (Johnson & Johnson, 1999), on the other hand, sees collaboration as an end product that results from the sum of the contributions and actions of students individually (Beltrán-Martín, 2022). In this perspective, the authors distinguish three modalities of work with three types of incentives: cooperative, competitive and individualistic (Castellaro et al., 2011). In the first case, individuals are rewarded based on their work as a team. In the second case, the performance of each individual is compared and only the best are rewarded. Finally, in the individualistic structure, individuals are rewarded based on their individual performance, regardless of the others' performance (Slavin, 1983).

One of the main principles of this theory is that students who work cooperatively outperform those who work individually or competitively (Gillies, 2004). In the cooperative incentive structure, unlike the others, students perceive that they only achieve the goals to the extent that the other members of the group also achieve them (Deutsch, 1949).

However, a number of authors (Dillenbourg, 1999; Lewis, 2003; Panitz, 1997) make a distinction between the concept of *cooperation* and that of *collaboration*. While the former refers to the combination of tasks and functions performed individually, the latter refers to a collective work where all members of the group perform the tasks together from the beginning (Roselli, 2016b). In this sense, the theory of collaborative learning is not only derived from the cooperative learning approach (Johnson & Johnson, 1999), but also adds contributions from the social constructivist approach, both from the neo-Piagetian and neo-Vygotskian perspectives (Castellaro et al., 2011; Roselli, 2016a).

Within the neo-Piagetian perspective is the sociocognitive conflict theory (Doise & Mugny, 1981; Perret-Clermont, 1984), originated within the Geneva School of Social Psychology. The authors argue that sociocognitive conflict plays a crucial role in the exchange with others, as it enables the cognitive decentering of the subject, allowing the construction of knowledge and the intellectual development of students (Roselli et al., 2022; Roselli, 2016a;).

Conversely, the neo-Vygotskian theory of intersubjectivity suggests that the value of collaborative learning lies in the benefits of scaffolding, mutual help, mutual stimulation, role complementation, broadening of the scope of action and control of contributions and activities (Roselli, 2016a). From this point of view, unlike those mentioned above, collaboration is a product that cannot be reduced to the sum of individual actions (Castellaro et al., 2011).

Likewise, the distributed cognition theory, also coming from the neo-Vygotskian perspective, considers that cognitive functioning is distributed in the sociocultural environment. This allows the group to be defined as a unit of cognitive functioning (Roselli, 2016a). Both the theory of intersubjectivity and the theory of distributed cognition argue that it is through interaction, participation, discussion and exchange of information that students manage to learn and co-construct knowledge (Arellano-Becerril & Escudero-Nahón, 2022).

The differences between the different perspectives can be seen not only in the theoretical postulates, but also in the methodologies used in the research. From a neo-Piagetian perspective, studies have been conducted using pretest/posttest designs, with individuals of the same age or developmental level performing operational tasks (e.g., conservation), with the aim of comparing the results of an experimental group with those of a control group. However, from a neo-Vygotskian point of view, the focus is on the analysis of social interaction, with individuals of different ages or developmental levels (Dillenbourg et al., 1996).

From the various theories mentioned above and the integration of information and communication technologies in the teaching-learning process, the theory of Computer-Supported Collaborative Learning (CSCL) emerges. It explores how such technologies support interaction and communication between group members, enabling virtual collaborative knowledge construction (Palacios-Núñez et al., 2022; Chen et al., 2018; van Leeuwen & Rummel, 2019; Badia et al., 2010).

## **Background and Objectives**

In this context, several authors have conducted bibliographic reviews of the topic. For example, Dillenbourg et al. (1996) identified three paradigms of collaborative learning research. Initially, research compared collaborative learning with individual learning to determine whether collaborative learning was more effective. Most studies found positive effects, although contradictory results were observed. The explanation for this contradiction lies in the fact that collaborative learning is efficient under certain conditions. This theoretical idea led to a second paradigm of research that explored these conditions, as well as the heterogeneity and homogeneity of the group, individual prerequisites, task characteristics, and the relationships between various variables. Finally, the third paradigm includes studies that answer the questions “Under what conditions do these interactions occur?” and “What are the effects of these interactions?”

Subsequently, Castellaro and Dominino (2011) identified two types of studies in a population of four- or five-year-old children: those that studied the influence of collaboration on children’s cognitive development, and those that studied the influence of different variables on the collaboration process. While in the first approach collaborative learning plays the role of an independent variable, in the second approach collaboration acts as a dependent variable.

Similarly, Chen et al. (2018) make a similar distinction to the above, but in a computer-assisted learning environment. The authors distinguished between studies that analyzed the effects of collaboration in these environments and studies that examined the influence of different variables on the collaboration process. In this second approach, we can mention variables such as; the use of computers compared to other media; the use of particular programs

and applications such as Moodle, Google Apps or Facebook; and the use of different strategies or tools to support collaborative learning in these environments, such as collaborative *scripts*.

A look at the bibliographical reviews of collaborative learning published in recent years reveals a lack of systematic comparative analysis using explicit and exhaustive analytical criteria that would allow these contributions to be organized. More precisely, the aim of this study is to propose a referential analytical model that allows a clear systematization of the corpus of articles recovered in the period 2018-2022.

Although there is an extensive bibliography on collaborative learning, there is a lack of systematization of what has been published in the last five years that would allow for an updated bibliography on the subject. This is the reason why this work focuses on the bibliographical retrieval produced in that period. But, in addition, this update is carried out through a model of analytical categories that systematize and organize these contributions. In other words, it is not simply a matter of bibliographic retrieval, but also, and more fundamentally, of proposing a multidimensional analytical model that allows the intelligibility of the corpus as a whole.

## **ARGUMENTATION**

### **Methodology**

The bibliographic search for this study was carried out in the following databases: SciELO, RedALyC, Eric and Dialnet. These databases were chosen because they are the most widely used by Spanish-speaking researchers on collaborative learning. This does not imply ignoring the fact that other databases, such as Scopus, Web of Science and ERIH PLUS, also contain important articles on the subject, especially in English. The selected databases mainly refer to articles in Spanish, which makes them more widely available in Latin American contexts. Undoubtedly, future developments could broaden the range of databases consulted to include articles from more diverse linguistic contexts.

In terms of procedure, the following search terms were used in Spanish and English to select relevant articles: “collaborative learning”, “cooperative learning”, “learning community”, “teamwork”, “sociocognitive interaction”, “peer collaboration”, “collaborative writing” and “collaborative work”. Then, based on the analysis of the summaries, articles were selected that met the following inclusion criteria: published in the last five years, empirical in nature, related to higher education contexts, and addressing specific learning situations. Articles that were not freely available or could not be accessed in full were also excluded from the analysis. Seventy-one articles that met the inclusion criteria were retrieved.

### **Analytical Model**

The proposed analytical model responds to the following criteria: theoretical orientation, geographical context of origin, teaching modality involved, school setting, disciplinary content, analysis type, learning aspects or moments, strategies and techniques used, and size of groups or collaborative units. These analytical criteria, according to the methodological terminology,

constitute the variables of the proposed model, which can adopt different modalities or variations. Table 1 shows the modalities of each of these analytical criteria or variables identifiable in the corpus of articles collected, together with the frequencies of the articles retrieved.

**Table 1.**  
*Analytical variables with their corresponding modalities and frequencies*

<b>Variables</b>	<b>Modalities</b>	<b>Frequency</b>
Theoretical approach	Social constructivism (SC)	51
	Pragmatic behavioral (PC)	15
	Both (SC + PC)	5
Geographical context	Latin American (L)	21
	European(E)	20
	Anglo-Saxon (AN)	9
	Asian (AS)	16
	Eurasian (EA)	3
	African (AF)	1
	Various (V)	1
Teaching modality	Virtual synchronous (VS)	10
	Virtual asynchronous (VA)	14
	Virtual mixed (VM)	5
	Face-to-face Synchronous (PS)	24
	Face-to-face Asynchronous (PA)	0
	Face-to-face Mixed (PM)	0
	Hybrid synchronous (HS)	0
	Hybrid asynchronous (HA)	0
	Hybrid mixed (HM)	3
University environment	Classroom-based (A)	47
	Outside the classroom (EA)	9
Disciplinary content	Social sciences (CS)	25
	Exact sciences (CE)	15
	Literary sciences (CL)	9
	Biological sciences (CB)	6
	Art (AR)	1
Analysis type	Production analysis (AP)	28
	Verbal communication analysis (ACV)	13
	Mixed analysis (production and verbal communication) (AM)	13
	Nonverbal communication analysis (ACNV)	2
	Opinion analysis (AO)	15
Learning aspects or moments	Cognitive elaboration (EC)	27
	Appropriation of bibliography (AB)	6
	Writing (ES)	18
	Mixed(M)	4
	Not specified (NE)	1
Strategies and techniques implemented	Essay (EN)	17
	Summary (R)	2
	Concept map (MC)	5
	Problem solving (RDP)	7
	Project (P)	9
	Forum (F)	2
	Tutoring (T)	1
	Questionnaire (C)	6
	Virtual games (JV)	2
	Recreational activity (AL)	1
	Miscellaneous (V)	3
	Not specified (NE)	1

**Table 1.** (continued)

Variables	Modalities	Frequency
Group size	2	12
	3	1
	4	6
	5	6
	2 and 3	2
	2, 3 and 4	3
	3 and 4	7
	3, 4 and 5	2
	4 and 5	3
	4 and 7	1
	5 and 6	2
	Full class (CC)	2
	Not specified (NE)	9

Source. Elaborated by the author.

## Analysis of the Corpus Selected

Seventy-one research studies on the subject of collaborative learning at university level were retrieved. The first part of the manuscript analyzes this corpus of retrieved research in terms of the analytical criteria constructed or variables. In this section, each of these criteria (variables) is analyzed independently, commenting on some of the articles retrieved by way of example. Table 1 shows the frequencies of the 71 articles retrieved.

In the second part, the analytical criteria or variables of the proposed model are analyzed in an inclusive manner, i.e. by linking these variables to each other. On the basis of this inclusive systematization of these variables, 12 articles were selected that can be considered paradigmatic of these variables and classificatory modalities.

### 1. Analysis of all retrieved research (71)

As mentioned above, this section analyzes the 71 research studies recovered according to the criteria or analytical variables proposed.

#### *1.1. Theoretical approach.*

Within the theoretical orientation, the proposed model distinguishes between a social constructivist view and a more pragmatic behavioral approach. The social constructivist perspectives, it is worth the redundancy, are those that emphasize collaboration understood fundamentally as a social constructive construction. In contrast, the second approach emphasizes cooperation as the result of the sum of individual actions. As shown in Table 1, collaborative learning is currently most often defined by authors from a social constructivist perspective, and less often from a pragmatic behavioral approach or from an integration of both perspectives.

From a social constructivist perspective, some authors (Pham, 2021) rely on postulates of classical authors such as Vygotsky when defining collaborative learning, emphasizing the fundamental role of language, culture, cultural artifacts and dialogue. Others (Silva et al., 2022) rely on a rather neo-Piagetian perspective, emphasizing the importance of the sociocognitive conflict in collaborative learning processes. Likewise, there are authors (Hernández et al., 2020) who mention the theories of intersubjectivity and distributed cognition, both framed in a neo-Vygotskian perspective.

Irrespective of the particular theory on which they rely, social constructivist authors agree in placing particular emphasis on social interactions. It is in these interactions and negotiations that students are able to construct new knowledge and generate shared meanings (Borge et al., 2018; Heimbuch et al., 2018; Rojas et al., 2019; Hayashi, 2020; Heinonen et al., 2020; Pham, 2021; Tan et al., 2021).

Conversely, from a pragmatic behavioral perspective, the authors define collaborative learning as a teaching method or strategy in which students work in groups to achieve a common learning goal. In this case, the emphasis is not on the social interactions but on the goals to be achieved. In this sense, collaborative learning is based on the fact that in order for one member of the group to achieve his or her own goals, it is necessary for the others to achieve theirs (Silva et al., 2022; Ruiz, 2018). In turn, just as some authors from a social constructivist perspective rely on Vygotsky's statements, the authors from this perspective rely on Johnson and Johnson's postulates.

It should be noted that, with some exceptions such as the case of Olaya & González-González (2020), both from a social constructivist approach and from a pragmatic behavioral approach, the authors use the concept of *collaborative learning* regardless of the theoretical differences between the two perspectives. In this sense, the authors use the terms *collaborative learning and cooperative learning* interchangeably.

Finally, authors using both theoretical perspectives (Rode et al., 2018) refer to the same postulates as those detailed above, only in this case they are fostered by the integration of both approaches.

### ***1.2. Geographical context of origin.***

From a geographical point of view, it is necessary to recognize research produced in different contexts. The importance of this lies in the link with the theoretical approaches outlined above. In other words, theoretical perspectives develop preferentially in certain contexts. While the social constructivist approach is more developed in Europe, the pragmatic behavioral approach is more developed in the United States; this does not imply disregarding the social constructivist contributions registered in the latter country.

During the period analyzed, research was most frequently conducted in Latin American and Spanish countries. Of the 21 Latin American studies (Reyes-Cabrera, 2022), some were conducted in Chile, others in Mexico, Colombia, Argentina and Peru. Of the European studies



(Duret et al., 2018), those retrieved were from Spain, Germany, England, Finland, Greece, the Netherlands and Serbia.

Second, research studies conducted in Asian contexts were retrieved (Leng et al., 2021). These collaborative learning experiences were conducted in universities in China, Vietnam, Japan, Iran, South Korea and Taiwan.

Conversely, the nine studies conducted in an Anglo-Saxon context were conducted at different universities in the United States. Examples of these articles are Abrams (2019) and Menekse & Chi (2018).

Finally, three research studies conducted in a Eurasian context, one conducted in an African country and one that included students from Latin America and Europe were retrieved.

### ***1.3. Teaching mode involved.***

The proposed analytical model also distinguishes between different teaching modalities. Although the construct of *collaborative learning* originates in face-to-face situations, nowadays, due to the development of linking networks that allow interaction and exchange between students and teachers, the research also involves collaborative learning strategies in virtual contexts. In particular, if we exclude the 15 research studies specifically referring to opinion research on the use of collaboration, the research studies retrieved refer both to techniques and strategies in face-to-face contexts (24 studies) and in virtual teaching contexts (29 studies).

As for the face-to-face modality, all of them correspond, in turn, to a synchronous modality. For the virtual modality, there were activities that were carried out both synchronously, where participants worked by communicating verbally through the computer in real time (Cheng & Chu, 2019), as well as asynchronously. In the latter case, students worked on different platforms and/or programs. For example, in the research by Su et al. (2018) and Tao et al. (2022), different team members communicated and worked collaboratively through a wiki space on the Moodle platform and through a virtual chat on Tencent QQ. In the case of the study conducted by Barrera et al. (2021), students were required to participate in a virtual forum. As shown, the platforms, programs and tools used to support the communication and collaboration processes in an environment are very diverse.

However, only three articles were found that studied collaborative learning in a hybrid mode, where both types of modalities (face-to-face and virtual) were combined at different times, or where some of the participants were involved in a face-to-face modality and others in a virtual modality. In the case of the article by Zheng et al. (2020), face-to-face and virtuality were combined at different times.

### ***1.4. University environment.***

Traditionally, collaborative learning assessments have been conducted both in classrooms within educational institutions and in laboratories for experimental purposes (Fernández & Melero, 1995). For this reason, this model distinguishes between a specific

classroom environment, which refers to the acquisition of knowledge in the various curricular subjects, and an environment outside the classroom, which refers to experimental environments created ad hoc with strict research purposes.

It is worth noting that, of the empirical research collected, if we exclude the 15 studies specifically concerned with opinion research on the use of collaboration, 47 of the 56 studies analyzed in this section were carried out in different university lectures or courses. For example, the study by Järvenoja et al. (2019) was conducted in a mathematics course, and the study by Sadita et al. (2020) was conducted in a computer science course.

Only in nine articles were collaborative activities carried out outside the classroom. These were experimental situations.

### ***1.5. Disciplinary content.***

When it comes to collaboration for learning knowledge, the epistemic knowledge type generates different developments. It is therefore essential to be able to distinguish between research that works with content from the exact sciences and research that works with content from the social sciences or other disciplines. Likewise, the relevance of this analytical criterion is not only related to epistemic knowledge per se, but also to the faculties or academic sectors that host these instances of collaborative learning, since each one of them has certain traditions when it comes to carrying out collaborative processes.

Within the collected research, the most common epistemic content was social sciences. General psychology (Hayashi, 2020), business administration (Ruiz, 2018) and communication sciences (Straub & Rummel, 2021) are some examples of social sciences included in the various research.

Second, 15 articles were collected where the episteme used corresponded to exact sciences. This category includes theoretical content from mathematics (Rafael-Cosme, 2022), computer sciences (Borge et al., 2018) and engineering (Aqlan & Zhao, 2022).

In nine of the collected studies, the episteme came from literary sciences. In this case, the theoretical content was generally related to language learning. For example, in the article by Abrams (2019), the content was related to German language learning.

Finally, six research papers were collected where the epistemological content was related to the biological sciences, while a single article referred to arts (Zheng et al., 2020).

### ***1.6. Analysis type.***

Empirical research on collaborative learning has focused on studying both the production or end product of the learning instances and the verbal discourse that is established between group members as they carry out the activities. This is related to the theoretical approach, as the different perspectives are related to certain analytical patterns.

The analysis of production was the most frequently observed; it applies specifically to students' productions, both at individual and group level. The means of analysis used are very diverse. The different research studies evaluate, among other things, the knowledge acquired, the level of production achieved in the tasks, the skills or abilities developed. For example, Pham (2021) analyzed students' written productions before and after group activities.

Instead of analyzing the product of collaborative learning, 13 studies analyzed the discourse generated during the process, both virtually and face-to-face. For example, Leng et al. (2021) analyzed the online discussions of the different groups, taking into account the revision behavior and the level of knowledge construction.

Similarly, 13 research studies were retrieved that used a mixed analysis. These are those articles that examined both the students' product or production and the discourse they used during learning activities. Ecos et al. (2020) evaluated different aspects of the process, including: student performance, individual student learning, student participation, the organizational structure of the groups and the learning strategies used.

In addition, two studies were found that analyzed students' nonverbal communication. Guo & Barmaki (2020) analyzed, among other questions, the frequency with which students shared glances divided by the total number of frames captured. They studied the moments when the group members looked at the same spot.

The opinion analysis modality refers to a type of analysis that focuses on the students' evaluative opinion of the collaborative activities. This opinion refers both to the use and experiences made in the university activities, as well as to the evaluation of the difficulties and achievements of the same. Within the classification criterion type of analysis, 15 research studies were identified that measured neither the product nor the process of collaborative learning, but rather assessed the opinions or reflections that students or teachers might have after completing the collaborative tasks.

These articles were not considered in the analysis of all the variables or classification criteria. They were only taken into account in the criteria of *theoretical approach*, in the *geographical context of origin* and *analysis type*. This is because several of these studies did not measure the implementation of a specific collaborative activity, but rather measured opinions about collaborative learning in general. For example, Rode et al. (2018) conducted focus groups with students from different majors and asked about these students' experiences on collaborative learning and the technology tools they used to support these activities.

### ***1.7. Learning aspects or moments.***

As with the type of epistemic knowledge, collaboration used at different moments of learning generates differential developments. In this sense, when students collaborate to carry out a cognitive elaboration, to appropriate the bibliography or to write a synthesis, the interaction, the meanings and the shared knowledge produced are different for each type of activity. It is therefore important to distinguish at what point in the learning process collaborative activities take place.

From the bibliography collected, the most common category is *cognitive elaboration*, where students had to discuss, reason and create new knowledge or solutions. In this type of collaboration, students were intended to find solutions to different problems (Ecos et al., 2020), verbally explain different concepts to a fellow student (Hayashi, 2020), formulate arguments on different topics (Duret et al., 2018), make connections between different concepts (Sadita et al., 2020), and generate ideas for projects (Baturay & Toker, 2019).

Similarly, 18 research studies were found that used collaborative learning strategies and techniques in relation to writing, where all students carried out a collaborative writing task with different instructions (Teng, 2021). Conversely, regarding the activity of appropriation of the bibliography, six studies were found in which students had the aim of learning theoretical content by reading bibliographies or watching videos (Schnaubert & Bodemer, 2022). It is worth noting that in these studies the students also had to debate, reason and construct new knowledge, just like the students who only carried out a cognitive elaboration.

Finally, we found four studies that combined the three moments of learning (Su et al., 2018) and one study that did not specify the moment of learning in which the collaborative activity was developed (Luque et al., 2021).

### ***1.8. Strategies and techniques implemented.***

This analytical variable is closely related to the learning moment previously analyzed. As with the previous variable, the different collaborative learning strategies and techniques used lead to different developments.

The bibliography collected shows that a wide variety of strategies and techniques have been used in research over the last five years. The most common technique was to write an essay with different epistemic content. In several of these studies, the aim of writing was for students to improve their learning of another language (Abrams, 2019; Teng, 2021).

Second, nine studies were found where students carried out a project with a specific task for each case. For example, in the study conducted by Zhang et al. (2021) students designed a didactic program using technology.

There were also six studies in which students completed a questionnaire collaboratively. Each of these questionnaires had a different aim. For example, in the study by Schnaubert & Bodemer (2022), students completed a questionnaire that assessed their reading comprehension of a text related to blood glucose regulation. And in the study by Menekse & Chi (2018), the questionnaire was used more as a guide for interpreting information presented in graphs and figures.

Likewise, there are five studies in which students collaboratively constructed a concept map (Zheng et al., 2020) and seven studies in which students collaboratively solved different problem situations (Järvenoja et al., 2019).

Few studies were found that used techniques other than those mentioned above, including summary writing (Granado-Peinado et al., 2019), virtual forums (Duret et al., 2018), peer tutoring (Hayashi, 2020), virtual games (Rojas et al., 2019), and face-to-face play activities such as identifying body muscles with colors (Guo & Barmaki, 2020).

It should be noted that the vast majority of studies used only one strategy or technique. There were only three that used more than one technique, as in the case of Silva et al. (2022), where participants collaboratively created concept maps and completed a questionnaire about different educational scenarios. Of these studies, only one was designed to compare different techniques (Roselli & Cardoni, 2020).

### ***1.9. Size of groups or collaborative units.***

In terms of group size, the proposed model distinguishes between smaller units (dyads and triads), medium-sized groups (tetrads and quintads), larger units, such as groups composed of six or seven members and, finally, the entire class with no group distribution. This is important because collaborative learning is not the same depending on the number of participants.

In the articles collected, a variability in the size of the groups formed was observed. In fact, in 20 studies the groups were of different sizes. It should be noted that in these cases, the initial aim was not to deliberately differentiate or compare these groups, but it was a product of the number of participants. An example of such articles is that of Pham (2021). The rest of the research focused on a single group size.

It should also be emphasized that the vast majority of studies used different collaborative learning techniques in small or medium sized groups (two to six members). Only in two articles was the entire class found to be the unit of analysis: Duret et al. (2018) and Barrera et al. (2021).

Finally, nine studies were collected in which the number of members comprising each group was not specified, for example in the study by Baturay & Toker, 2019.

## **2. Specific Analysis of the Most Paradigmatic Publications**

As mentioned above, this section analyzes, in a comprehensive manner, the proposed analytical criteria applied to a selection of the most paradigmatic articles. They were considered as such because they represent the whole corpus analyzed, in the sense that they respond to the most frequent modalities of the different variables. They can therefore be considered as a kind of summary or representative sample of the whole corpus.

This analysis responds to a successive inclusion criterion, which means that each of these studies represents an inclusion option of the nine variables analyzed, according to the corresponding modality.

The modalities corresponding to each of the analytical variables of the paradigmatic studies are summarized in Table 2, as follows.

**Table 2.**  
*Variables and modalities of the most paradigmatic publications.*

Article	Theoretical approach	Geographical context	Teaching modality	School environment	Discipline	Analysis type	Learning moments	Strategies and techniques implemented	Group size
Lambić et al. (2018)	PC	E	PS	A	CE	AP	EC	RDP	4
Aqlan y Zhao (2022)	PC	AN	PS	EA	CE	AP	EC	RDP	2, 3 y 4
Niño-Carrasco & Castellanos-Ramírez (2020)	SC	L	VA	A	CS	ACV	ES	EN	4
Hernández Rojas et al. (2020)	SC	L	VA	EA	CS	AP	ES	EN	NE
Nykopp et al. (2018)	SC	E	VA	A	CS	AM	ES	EN	2, 3 y 4
Tan et al. (2021)	SC	E	PS	A	CS	ACV	EC	MC	5 y 6
Hayashi (2020)	SC	AS	VS	EA	CS	AM	EC	T	2
Teng (2021)	SC	AS	PS	A	CL	AP	ES	EN	NE
Schneider et al. (2020)	SC	AN	PS	A	CE	ACNV	EC	P	2

*Source.* Elaborated by the author.

First, two articles with a pragmatic behavioral theoretical approach were selected. In the first research, by Aqlan & Zhao (2022), they specifically studied how a collaborative learning technique influences the effectiveness of collaboration in solving problem situations. The project involved 37 engineering students from a US university. Working in groups of no more than four, they designed and built toy cars. The analysis in this case was reduced to the individual measurement of the different skills (analytical, metacognitive, thinking, flow and collaboration) and conceptual knowledge acquired by the students, using different questionnaires, scales and inventories.

In the second research, Lambić et al. (2018) tested the use of an algorithm that allows grouping of collaborative teams according to the results of a pretest and according to students' interpersonal relationships and prosocial behavior. To achieve this goal, an experimental condition (groups formed using the proposed method) was compared with a control condition (groups formed randomly or chosen by the students themselves). Both the experimental and the control condition consisted of students from a university in Serbia who had to solve mathematical problems in tetrads. The data analysis was based on the results of an individual posttest.

Despite the methodological and contextual differences, these articles share some characteristics. Both were carried out in a face-to-face synchronous teaching modality where collaborative groups worked to solve different problem situations. The activities were not the same, but both refer to epistemic content from exact sciences, from which the students

collaboratively produced a cognitive elaboration. Likewise, in both cases the students' individual productions were analyzed. In this sense, both articles coincide with the theoretical postulates of the cooperative learning theory (Johnson & Johnson, 1999), framed in the pragmatic behavioral perspective. In this perspective, the focus is on individual actions and goals to be achieved, which means that articles using this approach tend to focus on individual student achievements and productions rather than collaborative analysis. Such productions concern both the final product and the knowledge, skills, abilities and strategies acquired through such activities. Similarly, the fact that *exact sciences* are one of the most recurrent disciplinary contents may be due to the fact that these sciences also focus on finding results or solutions to different problems.

Within a social constructivist approach, Nykopp et al. (2018) studied how students coordinate collaborative writing virtually, and how this coordination relates to the quality of the essays produced. The study included 28 educational psychology students at a university in Finland. In this study, the students conducted a collaborative trial in dyads or tetrads using Google Drive. On this platform they had a space where they could plan the task and another space where they actually wrote the essay. The analysis was based on both the quality of the essay and the way the students coordinated the activity. This last aspect was measured by categorizing the messages that the students sent in the space where they planned the task. Thus, this article could be circumscribed within the neo-Vygotskian perspective, particularly in the theory of intersubjectivity. As Roselli (2016b) explains, the focus from this perspective is on mutual help and control of contributions. Precisely, Nykopp et al. (2018) refer to the value of interactions, work distribution and participants' contributions, since this is what facilitates the construction of knowledge.

In the study by Niño-Carrasco & Castellanos-Ramírez (2020), a similar experience to the previous one was carried out, with the difference that the students were from a university in Mexico and the analysis was applied only to the students' verbal communication. Specifically, the aim of both studies was to explore and describe the different regulatory and coordination strategies that students use in collaborative writing.

In addition, the social constructivist articles take into account not only the analysis of interactions or verbal communication, but also the analysis of productions. This is the case in Teng's (2021) research, where 160 students at a university in China wrote several collaborative essays with the aim of developing their academic writing skills. The groups were divided into four different conditions: collaborative writing combined with metacognitive guidance; metacognitive training with individual writing; collaborative writing without metacognitive training; and a control group of individual writing without metacognitive training. The design was also of the pretest/posttest type, where students had to complete an individual evaluation questionnaire.

Another paradigmatic article of this theoretical approach is that of Hernández et al. (2020). This article, unlike the previous ones, is carried out from the point of view of the distributed cognition theory. Based on this theory, the authors designed a pedagogical proposal with the aim of promoting students, academic writing. This proposal involved the design of a distributed cognition activity system that included writing-to-learn protocols and model essay

samples. The former played the role of supporting the cognitive and metacognitive activities of the students, and the latter that of supporting the structure of the writing. The proposal was implemented on a sample of 25 Mexican students in an asynchronous virtual modality through the Moodle platform, which made it possible to record the interactions and the organization of the teams. After the collaborative activity, students completed the essays individually. Finally, both collaborative and individual essays were taken into account for the analysis.

However, although essay writing was the most observed technique in the research from a social constructivist perspective, the implementation of other collaborative learning techniques and strategies was also noted. For example, Hayashi (2020) studied how the use of two external facilitation methods in a CSCL context can improve the process and outcomes of collaborative learning. To this end, 80 Japanese psychology students worked in dyads. The dyads were physically in the same environment but could not see each other; they could only communicate via computers simulating a synchronous virtual teaching modality. The task was for the dyad members to explain a concept to each other. The analysis in this case was applied both to the dialogue established between the participants and to the assessment of learning at the end of the activity.

Borge et al. (2018) conducted an experiment similar to the previous one. The aim was the same: to test the use of facilitative methods. Although the method was not exactly the same, in both cases scripts were used to support the regulatory processes involved in computer-supported collaborative learning. The aim was to enhance collaborative knowledge construction. The technique used, group size and geographical context were different, but both Hayashi's (2020) and Borge et al.'s (2018) research analyzed discourse between participants in a synchronous virtual modality. Interestingly, a lot of dialogue was involved in the collaborative learning techniques in both cases. Whereas in Hayashi's (2020) article, students had to explain a content, in Borge et al.'s (2018) article, students had to discuss about it. These procedures allow for a more thorough analysis of the collaborative dialogue.

Another example of collaborative discourse analysis is the article by Tan et al. (2021). The difference between this article and the previous ones is that in this article students in groups of five and six constructed a collaborative concept map in a face-to-face teaching modality. Similarly, the aim of this research was to test certain scripts as scaffolds for collaborative learning processes. However, whereas in the previous research the scripts were used during the collaborative work, in the article by Tan et al. (2021) they were used individually before the collaborative activity. At the same time, it is worth noting that the three articles were conducted in different geographical contexts. The article by Hayashi (2020) was conducted in an Asian context, the article by Borge et al. (2018) in an Anglo-Saxon context, and the article by Tan et al. (2021) in a European context.

Conversely, there are articles with a social constructivist theoretical approach, where not only the collaborative learning technique is different from the previous ones, but also the type of analysis used. In the study by Schneider et al. (2020), university students in the United States programmed a robot in dyads. The analysis of the data took into account not only the quality of the collaboration and the programming code developed by the groups, but also four measures of physiological synchrony. The special feature of this article is that it provides a new



type of analysis, focusing on nonverbal communication, which differs from the traditional types of analysis (production analysis and verbal communication analysis).

In turn, an article was selected that combines both theoretical perspectives: the pragmatic behavioral and the social constructivist. When defining collaborative learning, Silva et al. (2022) actually use the concept of *cooperative learning*. They define it as a teaching method or strategy in which students work in groups to achieve goals that are common to all members. When doing so, they rely on classic authors within the pragmatic behavioral perspective. Similarly, they mention the importance of the role of sociocognitive conflict when confronting ideas, as it is through interaction and debate that students are able to construct new knowledge or a shared solution, enabling the development of critical and creative thinking. The methodology of this research was a pretest/posttest design. Psychology students from a university in Portugal worked in groups of four to five members, carrying out different activities: analyzing problematic situations, reading and analyzing articles, giving an oral presentation and, in some groups, elaborating a conceptual map. The analysis was applied to the tests used as pretest and posttest to measure critical and creative thinking in order to compare the differences between the different groups (those who worked individually, those who worked collaboratively but did not elaborate a concept map, and those who worked collaboratively and elaborated a concept map) in the development of these thinking skills.

Finally, one article was selected to represent the 15 studies (with different theoretical approaches) whose particularity lies in the fact that the analysis focuses on the opinions or perceptions of the different actors involved in the collaborative learning situations, whether tutors or students. In the specific case of Niari's (2021) research, interviews were conducted with tutors from the School of Humanities at a university in Greece. The interviews inquired about the use of collaborative learning techniques in teleconferencing, the value they attached to its use, and the concept of group dynamics.

## CONCLUSIONS

The analysis of the paradigmatic articles allowed us to detect different lines of research that exist in the period 2018-2022 on collaborative learning at university level. A first line is framed within the pragmatic behavioral perspective. These studies coincide with the second research paradigm mentioned by Dillenbourg et al. (1996) in their literature review, where they explored the conditions under which collaborative learning is more efficient. In particular, the chosen paradigmatic research conditions refer specifically to a collaborative learning technique (Aqlan & Zhao, 2022) and a group formation method (Lambić et al., 2018). To achieve this objective, the collaborative learning experiences of this line are carried out in a face-to-face teaching modality, where students must find the solution to different problematic situations in groups, with epistemic content from exact sciences. The analysis in these cases refers to individual productions, without considering collective productions; and, by individual productions we mean both the knowledge acquired by the students and the skills or abilities developed by them, as measured by questionnaires, scales or inventories.

A second line of research, in line with the third paradigm identified by Dillenbourg et al. (1996), focuses on studying the interactions that take place in the collaborative learning

process and the effects of these interactions on the learning process. In these studies, collaborative groups conduct an essay with an episteme corresponding to the social sciences in an asynchronous virtual modality. In particular, this is observed in the studies of Nykopp et al. (2018) and Niño-Carrascos & Castellanos-Ramírez (2020), which explore a specific aspect of interaction: coordination and regulatory strategies, respectively. Unlike the previous line of research, this one analyzes verbal communication during the collaboration process. Since the teaching modality was asynchronous virtual, the data collected for the analysis comes from the messages written by the students through the different platforms. This does not mean that we ignore the fact that this line of analysis can also be used for mixed analysis, combining the above analysis with the collaborative production analysis.

The bibliographical research carried out allows us to identify a new paradigm in addition to the previous ones mentioned by Dillebourg et al. (1996). In the last five years, several articles have been collected that study collaborative learning strategies which can enrich interactions. These strategies include orientations, guides, training, scripts and scaffolds that support collaborative processes so that students can plan, organize and coregulate collaborative activities, distributing roles, responsibilities and tasks equitably.

From a methodological point of view, within this new paradigm there are, on the one hand, studies that analyze students' collaborative productions to prove the effectiveness of such strategies or pedagogical proposals, and, on the other hand, studies that analyze students' collaborative discourse. The articles by Teng (2021) and Hernández et al. (2020), which, again, share the use of collaborative writing as a learning technique, are classified in the first approach. The studies by Borge et al. (2018) and Tan et al. (2021) are classified in the second approach. It is worth noting that in this second approach, the teaching modality is both virtual synchronous and face-to-face synchronous, so the data collected are students' oral verbalizations. As with the second line of research, this does not mean that there are no articles in this paradigm that combine both types of analysis, as is the case with the research carried out by Hayashi (2020).

Finally, a last line of current research is identified, in which new types of analysis are added to the traditional ones. It has already been recognized by several authors that in research on collaborative learning, analysis is usually applied to productions and/or interactions. In the present work, 15 articles were found that analyzed students' or teachers' perceptions and two articles that included nonverbal communication in their analysis. In particular, the article by Niari (2021) and the research by Schneider et al. (2020), which studied four measures of physiological synchrony, were selected as paradigmatic.

In conclusion, the proposed analytical model allows us to detect the existing diversity in the articles published in the period 2018-2022. The 71 research studies collected study collaborative learning at university level in different geographical contexts and teaching modalities, using a variety of techniques and strategies, in collaborative groups of different sizes. There are also different types of analysis of the data collected.

Despite this diversity of research, the classification of the articles makes it possible to identify certain patterns. These patterns coincide with those previously identified by various authors (Dillenbourg et al., 1996; Roselli, 2016b) and add new contributions. In this sense,

research has been found that examines the interactions that occur in the collaborative process, certain conditions under which collaborative learning is more efficient, and the effectiveness of certain strategies to support students' interactional, regulatory and metacognitive processes. The most remarkable aspect of the retrieved publications is precisely this last point. Identifying strategies that are ideal under different types of conditions makes collaborative learning more efficient, promoting knowledge construction and the development of metacognitive skills.

The aim of the article was to update the last five years in the main bibliographical databases, with a view to elaborating an analytical model that would allow the information to be organized and systematized. For this reason, the double value of this review is emphasized. Like any proposal, it has its limitations, both in terms of the chronological space to which it refers, and in terms of the variables and modalities of the proposed model. All in all, it is a contribution that fills a gap, since an explicit model for systematizing information is rare.

**Authors contributions:** The authors have contributed to the development of all parts of the work.

**Conflicts of interests:** The authors declare that they have no conflict of interest in relation to the research, neither among the authors nor with third parties.

**Financing sources:** The research was financially supported by the School of Psychology and Psychopedagogy of the Pontificia Universidad Católica Argentina (UCA).

**Acknowledgments:** The authors are grateful for the collaboration provided by graduate assistants of the Research Center of Psychology and Psychopedagogy of the UCA.

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