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Teaching to write collaborative argumentative syntheses in higher education

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Abstract

Writing argumentative syntheses based on multiple sources implies integrating ideas from different, often conflicting, positions. This can promote more constructive learning, especially when students undertake the task together with their peers. However, despite the importance of this activity in the university context, students generally lack the competency required. Thus, the primary objective of this research is to analyse the impact of a specific intervention programme (CPG + EICS) that combines help designed to foment collaboration with help aimed at improving the writing of argumentative syntheses, improving the quality of the university students' work, whether undertaken individually or collaboratively. For this we designed an experimental study with one hundred and sixty participating psychology students, distributed randomly into four different intervention programmes. We then compared and contrasted the impact of the already mentioned first programme (CPG + EICS) with that of the three others in which we progressively reduced the help provided (explicit instruction with video modelling, a guide and collaborative practice). We evaluated the quality of the syntheses by examining the number of arguments and their degree of integration within the students' texts. The results demonstrate that, to achieve the appropriate competency level, the intervention should include explicit instruction with video modelling. When this instruction combines help aimed at improving the elaboration of argumentative syntheses with help designed to foment collaboration, students integrate a higher level of contradictory information. However, to identify a high level of arguments, explicit instruction focused solely on helping students write argumentative syntheses turns out to be as effective as help directed at collaboration. In addition, after the intervention encouraging collaborative work, students successfully transfer the skills developed to their own individual writing tasks.

Keywords Collaborative writing · Higher education · Written synthesis

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Introduction

Writing has always played an important role at universities due to its relation with the development of expert knowledge (Tynjälä, 2001). In particular, writing argumentative syntheses based on multiple, contradictory sources has traits which make it an ideal task to promote constructive learning compared to purely reproductive learning. The uniqueness of this type of task resides in the need to create meaning based on different points of view, integrating conflicting information from the source texts and thereby possibly increasing students' critical thinking skills (Nussbaum & Scraw, 2007). When students also have to incorporate their own points of view in addition to others', the processes implied in writing these argumentative syntheses are externalised and can be studied (Nykopp, Marttunen, & Laurinen, 2014). As a result, the advantage of using writing as a learning tool heightens due to the opportunity that collaboration provides to jointly reflect on and create socially shared meaning (Onrubia & Engel, 2009).

The importance of teaching to write argumentative syntheses based on multiple sources in higher education

In the university context, the majority of faculty include source-based writing as part of their repertoire of teaching and learning activities (Perin, 2013). That notwithstanding, writing does not necessarily improve the learning process. The possibility of using it as a learning tool will depend on the types of tasks faculty propose as well as the way in which students complete these (Mateos, Solé, Martín, Cuevas, Miras, Castells, 2014; Klein, 1999).

In particular, writing syntheses based on multiple sources is a hybrid task in which students have to alternate their roles as readers and writers in order to reorganise the information from the sources, select the most important ideas and then connect them (Spivey, 1997). All this requires the ability to create meaning by integrating information from each of the texts (intratextual integration) as well as the ability to connect and unite ideas from the different sources (intertextual integration) (Segev-Miller, 2007). In addition, when the information provided in the various sources clashes, students not only have to identify this conflict and compare the differing ideas; they also face the challenge of finding an integrative solution, a task which may promote more constructive learning (Mateos, Cuevas, Martín, Martín, Echeita, Luna, 2011; Wiley, Steffens, Britt, & Griffin, 2014).

In this research, when talking about writing syntheses based on multiple sources with contradictory positions regarding a given topic, we refer to an argumentative synthesis writing task in which students have to identify and select both arguments and counterarguments based on various texts, taking into account different perspectives on the same problem and then comparing and integrating them to create a new and original text with an integrative conclusion (Mateos, Martín, Cuevas, Villalón, Martínez, González-Lamas, 2018). Students can adopt different strategies when preparing their final conclusions. Nussbaum and Schraw (2007) propose three strategies

to integrate arguments and counterarguments: *refutation*, when writers argue against contrary positions seen as invalid or weak in order to justify a given position; *weighing*, when the writers argue that the evidence supporting a given position is stronger than that of a contrary opinion or when the advantages of a given argument outweigh its disadvantages; and, lastly, *synthesising*, when the conclusion includes an integrative solution that combines the benefits of both. The first strategy encourages students to defend their respective positions, using the contrary positions solely to refute or discredit them. However, weighing and synthesising strategies imply exploring and reconciling different points of view to integrate contradictory positions. These last two strategies are the only ones that seem to be clearly involved in two-sided reasoning (Nussbaum, 2008a), offering students the opportunity to consider others' points of view as well as their own and thus facilitate their integration. Effective integration is important because it requires students to examine how the different arguments and counterarguments interrelate, helping them to define and organise their own thoughts. This could help to develop students' critical thinking skills and have long-term effects on consolidating their learning (Nussbaum, 2008b; Nussbaum & Schraw, 2007).

Despite the importance of this task in the higher education area, university students do not generally have the competency level required when writing these types of texts. This seems to be due to the cognitive demands of the task as well as the need to understand the basics of argumentative writing, identifying arguments within academic texts, integrating arguments and counterarguments from various sources and regulating the process of writing argumentative texts (Mateos et al., 2018; Bañales & Vega, 2016; Segev-Miller, 2004). In this respect, prior research has indicated that university students tend to argue in favour of a single point of view and/or refute the contrary one when asked to write argumentative texts (Cuevas, Mateos, Martín, Luna, Martín, Solari, González-Lamas, Martínez, 2016; Mateos et al., 2018; Nussbaum & Schraw, 2007). Given that there is increased demand for this type of text in the university context and that students are exposed to controversial topics and have to address different sources of information (Rouet, Britt, Mason, & Perfetti, 1996), teaching them to overcome these challenges is essential.

For all of the above, elaborating argumentative syntheses based on multiple texts that include contradictory information may be a positive means to use writing epistemically, thus favouring cognitive conflict, promoting more constructive learning and contributing to the development of perspectivism amongst students (Mateos et al., 2014). This is especially true when students carry out the task with others and can benefit from the potential that interacting with classmates affords.

The benefits of collaboration when writing argumentative syntheses

Writing has traditionally been seen as an individual endeavour, but the truth is that, in contexts such as the educational one and higher education, in particular, students are often challenged to write texts in pairs/dyads or small groups to give

presentations, participate in seminars and undertake research (Nykopp et al., 2014; Prichard, Stratford, & Bizo, 2006; Wigglesworth & Storch, 2012).

Prior research has shown that collaboration can be beneficial and help to improve writing quality (McAllister, 2005), given that it encourages individual and joint reflection on the content (Mauri, Colomina, Clará, & Ginesta, 2011). This represents an opportunity to clearly define students' own points of view and compare them with other perspectives (Johnson & Johnson, 2009), spark new ideas, give and receive feedback (Storch, 2005) and/or regulate the different writing processes (Kuhn, Hemberger, & Khait, 2016). As a result, when students have to undertake a writing assignment together, they simultaneously activate both cognitive (Volet, Summer, & Thurman, 2009) and metacognitive processes (Cohen, 1994; King, 2002: Vauras, Iiskala, Kajamies, Kinnunen, & Lehtinen, 2003), as well as strategies to regulate social interaction (Johnson & Johnson, 2003). In particular, when faced with the task of jointly writing argumentative syntheses, students have the opportunity to make use of their individual information and knowledge as well as that provided by the other. Sharing information encourages students to externalise and specify both the processes implied by the task (selecting, organising, comparing and integrating the different arguments) as well as each team member's ideas and knowledge. This favours the construction of shared meaning, as well (Nykopp et al., 2014; Onrubia & Engel, 2009). In turn, this can promote a more in-depth understanding of the content and constructive learning thanks to the inherently diaologic nature of argumentation (Ferretti & Lewis, 2013; Nussbaum, 2008b). Consequently, collaborative writing can be seen as a cognitively distributed activity that includes constantly interacting internal and external representations (Klein, 2014; Klein & Leacock, 2012).

Various researchers adopting a socio-cultural focus have shown that collaborative argumentation can foster the individual's competencies when thinking about and preparing argumentative texts. In this respect, Kuhn et al. (2016) argue that dialogue in pairs encourages externalisation and reflection on individuals' own thoughts and ideas, developing not only their individual argumentative competencies but also their dialogic skills. Dialogic argumentation can, in this sense, be seen as a bridge for argumentative thought and writing. Thus, argumentation and collaborative discourse seem to promote a more in-depth understanding of the content, consolidating students' learning (Nussbaum, 2008b). In addition, regulating the writing process produced initially by interacting with others can have a positive effect on individual performance. In this same vein, Reznitskaya, Anderson, and Kuo (2007) argue that group discussions enable students to analyse and modify their own perspectives collectively, providing them the opportunity to experiment with and, ultimately, interiorise argumentative knowledge. Once students have interiorised the argumentation processes learnt in collaborative situations, they may no longer need social support to present their arguments adequately. Socialisation in collective dialogic contexts can thus promote individual argumentation competencies.

However, collaboration doesn't always contribute to regulate the writing process. The strategies that students adopt, especially when facing problems that arise when completing collaborative tasks, may favour or hinder collaboration and promote or inhibit the processes that explain their benefits. Amongst all the mechanisms analysed as drivers of success or failure in collaborative efforts (Nokes-Malach, Richey,

& Gadgil, 2015), this study focuses on those which facilitate constructive controversy and the regulation of interactions due to their relation with the object of study. By elaborating an argumentative synthesis based on contradictory information in collaboration with others, students have to be able to respond to the controversies that arise. In this sense, the studies undertaken by Johnson and Johnson (1992, 2003, 2009) indicate that the strategies enacted in controversial situations can be either destructive (win-lose, rejection and/or avoidance) or constructive (perspective taking, problem-solving and/or confirmation). Johnson and Johnson (2003) found that students who adopted more constructive strategies than destructive ones tended to be better at resolving the problems that arose when carrying out collaborative tasks. Constructively resolving these issues helped students to build coherent arguments and critically analyse and question others' positions. Consequently, teaching university students to define constructive controversy-resolution strategies seems key. This implies students adopting different perspectives, seeing controversies as a problem-solving process and/or confirming other points of view instead of taking for granted that they already have those skills (Johnson & Johnson, 2003; Thomas, 2014).

As we defended in previous studies (Cuevas et al., 2016), if constructive strategies imply adopting and integrating different perspectives to resolve a given controversy, the use of these strategies may influence and improve the elaboration of collaborative argumentative syntheses based on multiple sources which offer different perspectives on a controversial issue. In fact, university students who adopted and used constructive strategies produced higher quality argumentative syntheses with a greater number of elaborated arguments and fewer irrelevant ideas.

Collaborative writing teaching

To date, the majority of research on collaborative writing has focused on comparing the quality of products between collaborative and individual work (Shehadeh, 2011; Storch, 2005), analysing collaborative writing processes (Millian, 2005; Nykopp et al., 2014; Onrubia & Engel, 2009; Sturm, 2016; Yeh, 2014) and/or examining group dynamics (Dale, 1994; Marttunen & Laurinen, 2012; McAllister, 2005).

This study is interested in work that focuses on helping to strengthen collaborative writing. Within this context, some studies have designed intervention programmes to provide help centred on writing tasks prepared collaboratively. Such is the case with the study Van Steendam, Rijlaarsdam, Van den Bergh, and Sercu (2014) undertook, comparing the effectiveness of instructional methods in the university context whose aim was to improve the collaborative revision of texts. All the students in their study received instruction in a six-step strategy to revise a given text's content and structure. After this initial instruction, in one of the conditions or intervention programmes (modelling), the students watched a video of a couple applying the revision strategy in question. In the other programme (practice), the students put the revision strategy into practice without any other instruction. The results of this research indicated that modelling is a powerful tool to teach students to revise texts alongside others, independently of the pair's characteristics. By contrast, traditional practice only produced benefits depending on the competency of each individual

pair member. The study authors concluded that using the modelling instructional method was much more powerful than traditional practice as it cancelled out any possible differences between students. Within this line of research, the authors of this research previously designed a study which serves as a precedent to this one (Mateos et al., 2018). It aimed to evaluate the effectiveness of two intervention programmes targeted at improving the elaboration of argumentative syntheses. It was found that, to teach students to undertake this task, collaborative practice along with the support of a writing guide preceded by explicit instruction through video modelling led to better results in terms of the argumentative syntheses' quality.

Other researchers have focused their attention on fomenting collaboration. In this vein, a study by Scheuer, McLaren, Weinberger, and Niebuhr (2014) included a tool to regulate collaboration strategies (*collaboration scripts*) along with another one designed to support argumentative writing (*argument diagrams*). The authors wanted to test if combining both instructional methods led to more elaborate and critical discussions in online environments, something which could then imply greater learning. For this they used an online environment based on argument diagrams to provide a visual representation of the texts' arguments. This tool enabled students to visualise the arguments and interrelate them with arrows to thus create an argumentative structure. For its part, the collaboration script they prepared for their study and included in the online tool aimed to promote students' discursive structure in four phases: individual analysis of the texts; collaborative discussion on the texts; collaborative interrelation of the texts; and collaborative conclusion. The aim was to encourage productive collaboration and discussion norms through a series of instructions guiding students throughout the task. Students were split into two groups: one would only use the argument diagrams, while the other would use the latter along with collaboration scripts. The aim of the proposed task was for the students to collaboratively agree on and reasonably justify their positions on a controversial subject such as climate change. The study's results demonstrated that the pairs which used argument diagrams along with collaboration scripts presented a more elaborate discourse and greater learning perception than those who only used the argument diagrams. Thus, combining help focused on the task at hand and centred on collaboration proved to be more effective.

Bearing in mind the above-mentioned benefits and opportunities that collaboration provides writing, in general, and argumentative syntheses, in particular, it's important to take into account teaching collaborative strategies when designing intervention programmes. For collaboration to have a positive effect on the writing process, it seems that collaborators need to have some type of instruction or frameworks to support them (Van Steendam, 2016). To strengthen this collaboration, Dillenbourg (2002) argued that support can be provided to students both before they begin working together as well as when they actually interact. In the first case, this help should aim to *structure* the collaborative process to encourage productive interactions, teaching students to collaborate and resolve problems before they occur. In the second case, the aim should be to help students to *regulate* their interactions, teaching them to identify, face and overcome problems that can arise during the writing process. To achieve these ends, explanations or scripts can be provided, detailing instructions on how to interact and resolve problems (Scheuer et al., 2014).

Similarly, students can be given process representations through modelling and observational learning techniques (Dale, 1994).

Given the above, analysing the role of specific instruction in collaboration processes in this context seems worthwhile. Asking students to work together doesn't seem sufficient to ensure constructive collaboration. The quality of their interactions, the way in which students manage their relation and the strategies they apply in controversial situations seem to have implications for their learning (Barron, 2003; Johnson & Johnson, 2003).

In this context, the aim of this study was to develop students' abilities to write argumentative syntheses based on multiple sources, instructing them not only regarding the processes involved in the synthesis-writing task, but also the strategies needed to resolve conflicts that might arise when working with others. The immediate precedent is a prior study in which we designed two intervention programmes that included different instructional components though with the same aim: teach university students to prepare a written synthesis incorporating information from two contradictory sources (Mateos et al., 2018). Both intervention programmes combined collaborative work with the use of a writing guide featuring graphic resources or organisers. However, one also included explicit instruction with video modelling of the processes involved in the task. The results indicated that the more complete programme, that is, the one that included collaborative practice with support from a writing guide preceded by explicit instruction with video modelling, was the most effective in significantly improving students' argumentative syntheses in terms of identifying and integrating arguments from the two source texts.

The prior study described did not include explicit instruction in the collaboration process itself. However, we know that, to evaluate the full potential of collaborative writing, disentangling the effect of this collaboration within intervention programmes may be necessary (Van Steendam, 2016). Our current study aims to move in this direction and analyse if explicit instruction in collaboration strategies helps to increase the already proven effect of explicit instruction in strategies when writing argumentative syntheses.

Objectives

Within this context, the general objective of this study is to analyse the differential effect of combining support for collaboration and support for writing argumentative syntheses to thus improve the quality of university students' products, both when working individually and collaboratively.

In particular, the specific objectives are:

1. Analyse the differential impact of interventions in the collaborative writing of argumentative syntheses which combine explicit instruction with video modelling of writing and collaboration processes along with a guide and collaborative practice. These focus on *argument identification* and on the *integration level* of arguments and counterarguments in students' final collaborative and individual syntheses. The effect of this intervention will then be contrasted with three other

intervention programmes in which the help provided is progressively reduced (explicit instruction only in the writing process with the support of a guide and collaborative practice; without any explicit instruction though the support of a guide and collaborative practice; without any explicit instruction or the support of a guide but with collaborative practice only).
2. Determine the degree to which students' ability to write collaborative argumentative syntheses after the intervention programmes (and evaluated through the student pair products) is transferred to individual writing assignments.

In keeping with these objectives, the initial hypotheses are as follows:

1. After the intervention programmes, participants in the most complete ones (including explicit instruction with video modelling, support of a guide and collaborative practice) will write better quality syntheses than students in programmes without any explicit instruction.
2. Similarly, students in the programme that includes explicit instruction with modelling on both writing and collaboration processes will write better quality syntheses than those solely receiving instruction in the writing process.
3. The quality achieved in writing collaborative syntheses after the intervention will be transferred to individual writing assignments.

Methods

Participants

Participants in this study included 160 second and third-year Psychology students (85% were female and 15%, male), distributed randomly into the four intervention programmes (CPG + EICS; CPG + EIS; CPG; and CP, see Table 1) described in greater detail below. In two of the sessions in each programme, students worked individually; in the other four, they worked in pairs. Pairs were also formed randomly within each programme.

The students included in the study sample voluntarily registered to take part in this research through the school's participation system. In exchange, they received some academic credit. This system, approved by an ethics committee, guaranteed the protection of the data used and established the ethical principles and commitments guiding their participation.

Table 1 Meaning of each intervention programme

CPG + EICS	Collaborative practice with a written guide supported by explicit instruction about collaborative writing synthesis
CPG + EIS	Collaborative practice with a written guide supported by explicit instruction about writing synthesis
CPG	Collaborative practice with a written guide
CP	Collaborative practice

Instruments and material

Intervention programmes

Four intervention programmes were designed, all of which aimed to improve the quality of students' argumentative syntheses. Though they all had the same goal, each programme included different components—such as explicit instruction with video modelling, a guide and/or collaborative practice—and taught different processes—writing and/or collaboration–. The most complete programme, CPG + EICS, included all four components and addressed the two processes implied in writing syntheses in pairs: writing and collaboration. The second programme, CPG + EIS, was similar to the first and included the four components though it only addressed the writing process. The third programme, CPG, implied the use of a guide though without any specific instruction; it also included collaborative practice. Lastly, in the fourth programme, CP, students were only able to benefit from collaborative practice.

Table 2 below summarises the components included in each of these programmes as well as the processes involved in writing argumentative syntheses taught in the corresponding intervention programmes.

Below are descriptions of the different components included in each programme.

Explicit instruction with video modelling

The aim was to provide students with information on the activities and processes implied by the synthesis writing task. One of the researchers explained the different ways to present arguments, emphasising the acquisition of knowledge by integrating information from different perspectives. The researcher presented the process of preparing an integrative conclusion as a seven-step procedure. Though these steps were presented linearly, the researcher emphasised the process' recursion. The first step implied reading the texts. The second and third related to identifying the arguments of each position, respectively. During the fourth step, the researcher taught the students to compare and contrast both positions to then prepare an integrative

Table 2 Components included in the intervention programmes and the processes addressed in those that included explicit instruction

	Components			Process involved	
	Explicit instruction with video modelling	Guide	Collaborative practice	Writing[a]	Collaboration [b]
CPG + EICS	X	X	X	X	X
CPG + EIS	X	X	X	X	
CPG		X	X	X	
CP			X		

[a]Reading, identifying, comparing and integrating arguments, textualisation and revision

[b]Constructive and destructive strategies to resolve controversies and regulate interactions

conclusion in the fifth stage. The sixth step focused on organising ideas to transfer them to the written text. Lastly, the seventh step implied revising the written text.

In addition to the stages dedicated to the writing process, instruction for participants in the CPG + EICS programme stressed the potential benefits of collaboration. The researcher in charge highlighted, on the one hand, the constructive and destructive strategies (Johnson & Johnson, 2003) available to resolve controversies that arose due to content, structure or task organisation, underscoring the need for positive and constructive collaboration. In addition, the importance of active listening and adopting their partners' point of view was highlighted to constructively resolve controversies, without imposing their own views and avoiding confrontation. On the other hand, the instruction focused on the importance of mutual regulation, proposing students become aware of the importance of regulating the task itself as well as the relation within the pair. The aim was to teach them that how they collaborated could reinforce the process of writing argumentative syntheses.

This explicit instruction also included a video that modelled the writing and/or collaboration processes (used in the CPG + EICS and CPG + EIS intervention programmes). The video featured a pair of students writing an argumentative synthesis face-to-face with the help of a guide to then prepare an integrative conclusion. The video lasted 15 min and 27 s, comprising seven scenes modelling each of the seven above-mentioned steps. The video also included titles to help students to focus on the strategy being modelled at different points.

Additionally for CPG + EICS programme participants, the video included two additional scenes dedicated to resolving conflicts (this video lasted a total of 16 min and 49 s), designed to support instructions regarding the use of collaboration strategies. The students in this video had to face two controversies which had previously been resolved destructively. The first illustrated a disagreement between the students regarding the task content—what arguments they should include from the source texts–, while the second featured a scene in which students had different points of view regarding the subject of debate. The aim was to show students how the way they resolve conflicts has an impact on the task of writing an argumentative synthesis.

Guide

We designed a guide adapted from previous studies (Mateos et al., 2018). They administered it to participants in the CPG + EICS, CPG + EIS and CPG programmes. This guide comprised a table to add the arguments identified in both positions in two separate columns and then interrelate them with arrows. This was followed by three blocks of questions to guide students' reflection: write an integrative conclusion (e.g., "Does any one position have more weight than others? Why?"); organise and textualise ideas (e.g., "In what order are you going to present the arguments?"); and revise the final text (e.g., "Have you included all the arguments you found and that justify your conclusion?"). The end of each block included a control mechanism to verify that students had used the guide to carry out the processes mentioned.

The guide designed for this study gave greater importance to graphic formats to emphasise the importance of prioritising and relating the arguments, providing

greater graphic expression. The guide that CPG + EICS programme participants received also included a list of suggestions on how to work constructively as a pair and regulate their interactions. These suggestions repeated the instructions given through the video modelling and put down in writing the importance of adopting different perspectives, confirming the partners' points of view, constructively resolving the problems that might arise and supervising the joint work (e.g., "Recognise your partner's good ideas, proposals and decisions and let him/her know."). The guide also proposed that the students take turns serving as supervisor in all four tasks carried out together (e.g., "Who's going to be the student-guide during this session? The student-guide will have to supervise to ensure that the different steps included in this guide are followed, promote dialogue if it doesn't occur and ensure that you find a solution in case a problem arises.").

The researcher in charge of this intervention taught students in the CPG + EICS and CPG + EIS programmes how to use the guide by means of explicit instruction with video modelling.

Collaborative practice

All the students participated in four collaborative practice sessions, elaborating an argumentative synthesis in pairs in each of these sessions.

Texts for the written synthesis tasks

We selected six pairs of argumentative texts, one for each programme session and the same ones for all the intervention programmes. Each pair of texts provided conflicting information about a controversial topic in the educational psychology field, representing a position in favour and another against the debate in question. Four of these texts were prepared and used in previous studies (Mateos et al., 2018), while the remaining two were created for this study adopting the previous texts' structure. Consequently, all the texts had a similar argumentative structure with an equivalent number of arguments and counterarguments (between 8 and 9) and a length spanning between 584 and 867 words.

Design and implementation

The experiment's design included two independent variables: the "intervention programme" with four levels (CPG + EICS, CPG + EIS, CPG and CP) and the "social organisation of the writing task" with two levels (collaborative and individual writing). The dependent variable was the quality of the syntheses, assessed using two criteria: "argument identification" and "integration level". In addition, students' initial skills in elaborating the syntheses were controlled both individually and collaboratively using the two above-mentioned criteria.

The study comprised a total of six 90-min sessions, one per week over six consecutive weeks and led by one of the researchers. In each session, the participants wrote an argumentative synthesis. The instruction for elaborating the argumentative

syntheses was the same for each session and programme. The researcher in charge spoke to participants either individually or in pairs depending on the task at hand:

> You are going to carry out a task which implies reading two texts about a controversial subject in the education field, texts which represent conflicting opinions. After reading the texts, you'll have to write your conclusions (individually/in pairs), basing your arguments on what you have read.

The first two sessions focused on evaluating students' initial skills in preparing the syntheses before participating in the intervention. In the first session, students were asked to elaborate an individual synthesis (*prior individual synthesis*). In the second session, participants were divided into pairs and wrote a collaborative synthesis (*prior collaborative synthesis*).

In the third session, the students in the different programmes received specific instruction as detailed above. In the programmes that didn't include explicit instruction with video modelling, students carried out a reading comprehension task to ensure that the instruction time was the same in all four programmes. This comprised reading a text on a controversial issue and responding individually and in writing to a series of related questions. The latter aimed for students to reflect and make inferences on the proposed topic as a means to improve reading comprehension. Later, the students in all the programmes carried out a collaborative synthesis task.

In the fourth session, the participants undertook a new collaborative synthesis writing assignment. Those in programmes CPG + EICS and CPG + EIS were able to make use of the strategies explained in the previous session. In addition, students in the three programmes in which the researchers provided the guide could make use of the latter. The researchers informed participants in the CPG programme who had not received any type of instruction in the previous session that they could use the guide to elaborate their syntheses, though without receiving any specific instruction in its content or possible use.

The fifth session was the last one in which participants worked in pairs to write an argumentative synthesis (*final collaborative synthesis*), though, this time, they were not allowed to use the guide. Finally, in the sixth session, participants wrote an individual synthesis (*final individual synthesis)* without being able to use the guide.

Upon completing the programme and for ethical reasons, participants who were not previously exposed to all the instructional components were invited to take part in an additional session to see all the material used as part of this study. Table 3 presents a synthesis of all the sessions.

Coding system

The quality of students' argumentative syntheses was evaluated based on two criteria as mentioned above: *argument identification*—the number of arguments identified in the source texts—and *integration level*—using a scale from 0 to 6 points–. Given that the texts included between 8 and 9 arguments each, the total number of arguments was transformed into proportions. Later, the arcsine inverse function was applied to ensure that the scores' distribution was normal.

Table 3 Session synthesis in each experimental intervention programme

	Experimental conditions			
	CPG+EICS	CPG+EIS	CPG	CP
Session 1	Prior individual synthesis			
Session 2	Prior collaborative synthesis			
Session 3	Instruction in W&C supported with the guide Collaborative synthesis task	Instruction in W supported with the guide Collaborative synthesis task	Reading comprehension task Implementing the guide Collaborative synthesis task	Reading comprehension task Collaborative synthesis task
Session 4	Collaborative synthesis task with support from the guide			Collaborative synthesis task
Session 5	Final collaborative synthesis			
Session 6	Final individual synthesis			

W&C (Writing and Collaboration) and W (Writing)

The integration level was evaluated using a scale from 0 (minimum level of integration) to 6 (maximum level of integration) used in previous studies (Mateos, et al. 2018). This scale was based on the type and frequency of the argumentative strategies used in the texts written by participants are presented in Table 4 (for a more detailed explanation, please see Mateos et al., 2018).

Two independent judges evaluated the quality of students' syntheses, codifying 20% of the 480 syntheses before (prior individual and collaborative syntheses) and after (final individual and collaborative syntheses) the intervention programmes. In terms of the proportion of identified arguments, inter-judge agreement was achieved by means of Chronbach's alpha (a coefficient of 0.92 for individual syntheses and 0.84 for collaborative syntheses). In terms of the integration level, Chronbach's alpha coefficient was 0.92 for individual syntheses and 0.89 for collaborative syntheses.

When agreement was impossible for certain syntheses, a third judge evaluated them to achieve consensus. One of the researchers then evaluated the remaining 80% of syntheses using the established criteria.

Treatment fidelity

To ensure the fidelity of the intervention's implementation, a script was prepared with the content to be covered in each intervention programme. The researcher in charge of each session made sure to follow the order and explanation for each component included in the script. Participants were not allowed to intervene during the intervention session to ensure that the information transmitted by the researcher was the same in all four intervention programmes.

Similarly, to ensure that the participants prepared and delivered their syntheses, students turned in their work after each session and signed an attendance sheet. On average, the individual syntheses included 544 words ($SD = 172.16$, while the collaborative syntheses included a mean of 429 words ($SD = 83.54$).

Table 4 Levels of the coding system for the quality of argumentative synthesis

Score	Overall argumentative strategy	Definition
0	Personal opinion	A personal opinion not based on the source texts
1	Neutral	A neutral conclusion
2	Argues in support	A conclusion in favour of one position
3	Integration via refutation	Takes a position in support one of the two perspectives and refuting the opposing perspective
4	Minimum integration via weighing or synthesizing	Takes a position in support of one or both perspectives and argues by weighing or synthesizing arguments from both positions Include a) two integrations only throughout the text or b) one integration throughout the text and another in the conclusion or c) two integrations, both in the conclusion
5	Average integration via weighing or synthesizing	Takes a position in support of one or both perspectives and argues by weighing or synthesizing arguments from both positions Include a) two integrations throughout the text and one integration in the conclusion or b) three or more integrations only throughout the text
6	Maximum integration	Takes a position in support of one or both perspectives and argues by weighing or synthesizing arguments from both positions Include at least two integrations throughout the text and in the conclusion weighs or synthesizes more than two arguments from each side

Data analysis

The scores used in the analyses when the participants worked in pairs comprised disaggregated averages. As a result, the scores obtained on the collaborative argumentative syntheses were assigned to each member of the pair.

To test hypotheses 1, 2 and 3 as related to the two objectives, two analysis of covariance (ANCOVA), 4 × 2, were carried out with an intersubject factor (intervention programme) and an intrasubject factor (social organisation of the writing task), one for each synthesis quality dimension (*argument identification* and *integration level*). In each case, students' initial skills in elaborating the collaborative and individual syntheses were introduced as a co-variable in the two above-mentioned quality dimensions.

Results

In terms of *argument identification*, Table 5 details the mean proportion of arguments identified in the prior and final syntheses for each of the conditions under study.

No main effects were found based on the social organisation of the writing task ($p = .65$), though they were present according to the intervention programme ($F(3,154) = 14.06$; $MSE = .36$; $p < .001$; $\eta^2 = .22$). The effect of the co-variables, initial skill in writing collaborative syntheses ($F(1,154) = 8.40$; $MSE = .21$; $p < .05$; $\eta^2 = .01$) and individual syntheses ($F(1,154) = 9.94$; $MSE = .25$: $p < .01$; $\eta^2 = .06$) was significant. Similarly, no significant interactions were found between the intervention programme and the social organisation of the writing task ($p = .32$) or between any of these variables and the co-variables (individual initial skill, $p = .34$; and collaborative initial skill, $p = .52$).

The Bonferroni post-hoc test was then applied, revealing that participants in programme CPG + EICS ($M = .73$; $SD = .11$) identified a higher proportion of arguments in their final syntheses than those completing programmes CPG ($M = .64$; $SD = .11$; $p < .01$) and CP ($M = .57$; $SD = .10$; $p < .001$). Similarly, those completing

Table 5 Mean proportion of arguments identified in the prior and final syntheses and standard deviation of the variable, "Argument Identification", based on the intervention programme and the social organisation of the writing task

	CPG + EICS n = 120 M(SD)	CPG + EIS n = 120 M(SD)	CPG n = 120 M(SD)	CP n = 120 M(SD)	Total M(SD)
Prior collaborative synthesis	.56(.09)	.56(.09)	.54(.18)	.57(.07)	.58(.12)
Prior individual synthesis	.65(.11)	.67(.15)	.68(.14)	.66(.13)	.67(.13)
Total	.60(.08)	.61(.09)	.61(.11)	.61(.08)	
Final collaborative synthesis	.73(.11)	.65(.19)	.62(.15)	.57(.14)	.64(.16)
Final individual synthesis	.72(.13)	.70(.15)	.65(.12)	.57(.12)	.66(.14)
Total	.73(.11)	.67(.15)	.64(.11)	.57(.10)	

programme CPG + EIS ($M = .67$; $SD = .15$) identified more arguments than those completing programme CP ($M = .57$; $SD = .10$; $p < .001$). There were no other significant differences between the programmes ($.19 < p < .83$).

With respect to *integration level,* the descriptives included in Table 6 show the level of integration achieved in each of the conditions studied.

No main effects were found for the social organisation of the writing task ($p = .18$), though they were present for the intervention programme ($F(3,154) = 29.99$; $MSE = 61.28$; $p < .001$; $\eta^2 = .37$). No interaction was significant ($.67 < p < .83$).

The results of applying the Bonferroni post-hoc test revealed that the integration level of the final syntheses elaborated by students that received explicit instruction in writing syntheses and collaboration, CPG + EICS, ($M = 4.25$; $SD = 1.18$) was higher than that achieved by students in all the other programmes ($p < .05$). In other words, after the intervention, students in the CPG + EICS programme successfully integrated arguments by weighing and/or synthesising them as opposed to students in other programmes. These CPG + EICS programme participants achieved a level 4 degree of integration on average. At the same time, students that received explicit instruction in synthesis writing, CPG + EIS ($M = 3.60$; $SD = 1.34$) wrote final syntheses with higher degrees of integration than those in the CPG ($M = 2.55$; $SD = 0.78$) and CP ($M = 2.36$; $SD = 0.59$) ($p < .001$) programmes, whose work only concluded in favour of one position which they integrated via refutation (level 3). No other difference between programmes was found ($p = 1.0$).

In sum, after controlling for the effect of students' initial skill in writing argumentative syntheses, the results indicated that the students that participated in intervention programmes with the explicit instruction component (CPG + EICS and CPG + EIS) identified a higher proportion of arguments in their final syntheses than the other students. Similarly, students that completed the programme featuring explicit instruction in both writing syntheses and collaboration (CPG + EICS) demonstrated higher levels of integration in their final syntheses than the students in the other programmes. Similarly, the quality of the final collaborative and individual syntheses was equivalent in all the intervention groups.

Table 6 Means and standard deviation for the variable, "Integration Level", in preparing the prior and final syntheses based on the intervention programme and the social organisation of the writing task

	CPG + EICS n = 120 M(SD)	CPG + EIS n = 120 M(SD)	CPG n = 120 M(SD)	CP n = 120 M(SD)	Total M(SD)
Prior collaborative synthesis	2.30(.65)	2.73(.96)	2.40(.98)	2.15(.77)	2.39(.87)
Prior individual synthesis	2.38(1.17)	2.25(1.19)	2.18(1.06)	2.55(1.22)	2.34(1.16)
Total	2.34(.66)	2.49(.85)	2.29(.78)	2.35(.67)	
Final collaborative synthesis	3.80(1.59)	3.30(1.76)	2.35(.98)	2.05(.60)	2.88(1.48)
Final individual synthesis	4.70(1.36)	3.90(1.52)	2.75(1.45)	2.68(1.12)	3.51(1.60)
Total	4.25(1.18)	3.60(.1.34)	2.55(.78)	2.36(.59)	

Discussion

The general objective of this study was to analyse the differential effect of combining help targeted at improving student collaboration and their ability to write argumentative syntheses, thus improving the quality of the products generated by the university students when carrying out collaborative and individual writing assignments.

With respect to the first hypothesis, the results corroborate the assumptions presented. Students who received explicit instruction with video modelling along with support from a guide and collaborative practice—independently of whether they received instruction in collaboration processes (CPG + EICS) or not (CPG + EIS)—identified a greater number of arguments and integrated a higher number of these in their final collaborative and individual syntheses compared to students in the other intervention programmes. These results are consistent with that found in a previous study (Mateos et al., 2018), underscoring that, to elaborate higher quality syntheses, collaborative practice and the use of a guide have to be accompanied with explicit instruction. Students that only benefitted from collaborative practice (CP) or collaborative practice in addition to a guide without specific instruction (CPG) produced less integrative syntheses, with a fewer number of arguments and conclusions in favour of a single position. This result is consistent with that found in previous research (Cuevas et al., 2016; Mateos et al., 2018; Nussbaum & Schraw, 2007). Seemingly, when university students have to work with argumentative texts, they tend to argue from a single position.

By comparing the quality of the syntheses elaborated by students in the two intervention programmes that included explicit instruction with video modelling, this study found that students participating in programme CPG + EICS (with instruction and modelling on both writing and collaboration processes) achieved a higher level of integration than students in programme CPG + EIS. However, contrary to expectations, there were no differences with respect to both programme participants' ability to identify arguments. Consequently, the second hypothesis holds true only partially. As Scheuer et al. (2014) found, combining help focused on the argument and collaboration tasks was effective, in this research, specifically in terms of encouraging a greater degree of integration. In the syntheses prepared before the intervention, students in all the programmes had difficulties in terms of integrating arguments from different sources, fundamentally concluding in favour of one of the positions and forgetting the others (level 2). After completing the intervention programme, the level of integration amongst students in the most complete programme (CPG + EICS), achieved a minimum level of integration by weighing and synthesising arguments (level 4). Those who received explicit instruction with video modelling only in writing (CPG + EIS) only succeeded in integrating arguments via refutation (level 3), despite showing progress in terms of their initial syntheses. This represents a significant development compared to previous levels, especially for the CPG + EICS programme. Consequently, though instruction in writing processes might be enough to identify arguments, instruction in collaborating strategies is necessary to improve the level of integration. One possible reason why explicit instruction in collaboration strategies doesn't seem to influence the number of arguments

students include in their syntheses might be, in this case, that collaboration benefits from several minds attempting to identify arguments and counterarguments. The added value of collaboration, then, would be that one of the two collaborators might identify an argument that the other has overlooked. However, this complementary external memory function which the other collaborator might provide is already highly supported by the guide in which both members are instructed to write down the arguments of each text in their respective table columns. It is probable that the systematic nature of this table provides sufficient help in the process of identifying arguments and that, consequently, explicit instruction has no differential effect.

The differences found between identifying and integrating arguments make clear that the help provided to improve the quality of argumentative syntheses and to foment collaboration has to be different depending on the collaborative writing process stage. In future research, we should bear these different stages in mind as occurs in other studies. In this respect, Kimmerle, Moskaliuk, Brendke, and Cress (2017) analyse the specific process of collaborative writing and the different collaboration stages (knowledge introduction, information restructuring and shared opinion), concluding that each stage requires specific support. It is possible that the controversy-resolution and interaction regulation strategies taught in our study were of fundamental help in the information restructuring stage or, in our terms, the joint preparation of an integrative conclusion. This result is novel compared to previous research given that, as described, it is possible that the argument identification stage, as a more familiar and easier task for students, is more easily systematised due to explicit instruction which modelled the use of the guide by students. However, weighing and integrating arguments from different sources implies greater cognitive demands. To this end, collaboration seems to facilitate the comparison and integration of different perspectives found not only in the texts but also between the team members. As demonstrated, collaboration may also have helped clarify and regulate the processes implied in the writing task, encouraging a more in-depth understanding of the texts. These results demonstrate that we cannot take for granted that students know how to collaborate appropriately. For this reason, we cannot forget that instruction should not only focus on the synthesis process itself but also provide help on how to strengthen collaboration and demonstrate the benefits of using constructive problem-resolution strategies.

In terms of the third hypothesis, as expected, students maintained the quality of their final collaborative syntheses when writing their final individual syntheses, both in terms of identifying and integrating arguments. These results represent another contribution of our study. To date, prior research in the field of writing argumentative syntheses has not explored the possible interiorisation of lessons on collaboration. In our research, we hypothesise on this transferral of the knowledge students acquire and, despite the fact that the interventions were designed to teach students to write argumentative syntheses in collaboration, when students faced this task individually for the first time without the support of the guide, they were able to maintain the level of argument identification and integration that they achieved collaboratively. As signalled by Reznitskaya et al. (2007), it seems that students were capable of appropriating the skill of integrating reasoned controversial positions

through an internalisation process, something they learnt in cooperative situations which implied group discussions.

Without doubt, our results indicate that the controversy-resolution and interaction regulation strategies included in our programme were fundamentally beneficial in the integrative conclusion writing stage. Conversely, graphic help included in the guide was helpful especially in the argument identification stage. That notwithstanding, these results stem from an analysis of the students' written output and not from the processes and strategies they implemented when completing the task. Thus, directly analysing the collaboration process would be worthwhile to be able to better understand how and in what collaborative argumentative synthesis writing stages collaboration can contribute and then design the corresponding intervention programmes.

This research also has several educational implications. In line with a previous study (Mateos et al., 2018), this research underscores the importance of teaching higher-education students to prepare argumentative syntheses. This study makes clear that these syntheses can be improved through dedicated instruction. This implies students learning to integrate information from different sources. Other scholars have found that learning to integrate arguments and counterarguments seems to facilitate critical thinking, a basic competency in this educational stage, and promote the consolidation of the knowledge acquired (Nussbaum, 2008b; Nussbaum & Schraw, 2007). For this reason, designing instructional tasks that transcend the purely formal and/or technical aspects of how to write a synthesis seems advisable. Students should be able to build their knowledge rigorously, learning to seek out integrative solutions and weighing the different perspectives beyond those proposed in the source texts.

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