



# Argumentation in collaboration: the impact of explicit instruction and collaborative writing on secondary school students' argumentative writing

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## Abstract

This paper has investigated the importance of explicit instruction and collaborative writing on (a) argumentative writing performance and (b) self-efficacy for writing of secondary school students. This intervention study additionally aimed to evaluate the effectiveness of alternating between individual and collaborative writing throughout the writing process (planning collaboratively, writing individually, revising collaboratively, and rewriting individually). A cluster randomized control trial (CRT) design was opted for. To investigate the effect of the intervention on secondary school students' writing performance and self-efficacy for writing, multilevel analyses were performed. It was found that the presence of explicit instruction in combination with collaborative writing is positively related to argumentative writing performance and self-efficacy for writing. Alternating between individual and collaborative writing was not significantly different from collaborating throughout all phases of the writing process. More in-depth research into the quality of collaboration is, however, needed to gain insight into the interaction processes and writing processes that take place during collaborative writing.

**Keywords** Argumentative writing · Collaborative writing · Explicit writing instruction · Self-efficacy for writing · Secondary Education

Writing is a very useful tool for learning, for expressing and exchanging ideas and feelings, and for participating in society (De Smedt et al., 2019; Graham et al., 2013). Despite the key relevance of writing in contemporary society, it is agreed that the education system fails to successfully promote students' writing performance. For

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instance, research in the U.S. showed that only 27% of twelfth' graders reached a level above "basic" writing performance (NCES US national center for education statistics, 2012). In Flanders, where the present study was conducted, secondary school students also experience difficulties when writing texts (Nederlandse Taalunie, 2015). An advisory report of Nederlandse Taalunie (2015) indicated that writing scores were very low in all schools that participated in the study. Additionally, in more than half of the participating schools, writing lessons were inadequately and poorly developed (Nederlandse Taalunie, 2015).

The situation is even more worrying when considering argumentative writing performance (Ferretti & Lewis, 2013). Argumentative writing is important to clarify our thoughts, to stimulate critical thinking and problem-solving skills, and to persuade others of a certain opinion (Granado-Peinado et al., 2019a; Nussbaum & Schraw, 2007; Varghese & Abraham, 1998). However, argumentative writing is intellectually challenging and many students have difficulties with it (Ferretti & Fan, 2016). Students' argumentative texts rarely acknowledge opposing positions, consider the merits of different views, or attempt to systematically integrate or rebut alternative perspectives (Ferretti & Lewis, 2013). Recent research also showed that argumentative texts are often weak and not factually accurate, have a weak level of persuasiveness, include errors involving the mechanics of writing, and often do not include counterarguments nor rebuttals (Landrieu et al., 2022).

## Complexity of the writing process

The difficulties regarding students' writing and argumentative writing in particular are related to the fact that the writing process is very complex. The complexity is theoretically framed in the Writing Within Community (WWC) model developed by Graham (2018a, 2018b). In the present study, the WWC model was used as the overall theoretical framework because of its emphasis on writing as a social activity, situated within different contexts involving writers, collaborators, readers, mentors, and teachers (Graham, 2018, p. 259). Given the dialogic nature of argumentation and the focus of the WWC model on the central role of communication in writing communities, this model is especially relevant for framing argumentative writing.

Besides the emphasis on writing as a social activity, the WWC model also highlighted the cognitive mechanisms that each individual in the writing community needs in order to write (Graham, 2018b). To be a good writer, it is essential to master the following: writing knowledge (e.g., knowledge about text genres), transcription skills (e.g., spelling), self-regulation skills (e.g., monitoring), and writing strategies (e.g., planning, writing, revising, and rewriting) (De Smedt et al., 2019; Flower & Hayes, 1981; Graham et al., 2013; Graham & Harris, 2000). According to the WWC model, writing is emotionally charged and emotions make writers want to do things, or not want to do things. Further, if students believe that they are good writers, writing tasks might result in greater effort and persistence (Graham, 2018b). Self-efficacy, therefore, plays an important role in the writing process, which is also reflected in the WWC model (Graham, 2018b).

## Instructional approaches to foster argumentative writing

One approach for improving secondary school students' argumentative writing is to provide instruction designed to enhance this capability (Graham et al., 2016; Graham & Perin, 2007; Van Drie et al., 2018). Research in this respect points at two promising instructional approaches that can potentially enhance both argumentative writing performance and self-efficacy for writing of students, namely explicit writing instruction and collaborative writing.

### Explicit writing instruction

Research by Ferretti and Lewis (2013), Graham and colleagues (2016), Granado-Peinado and colleagues (2019a), and Van Drie and colleagues (2018) indicated that explicit writing instruction is effective for fostering students' argumentative writing performance. Research in this respect distinguished between (a) explicit instruction on genre knowledge regarding writing argumentative texts and (b) on explicit instruction on writing strategies (Driscoll et al., 2020; Graham & Perin, 2007).

Explicit instruction on genre knowledge is necessary in order to write texts in a certain text genre (Graham et al., 2013). Genre knowledge is a resource to understand, engage and shape different types of writing (Driscoll et al., 2020). In the context of argumentative writing, students are taught how to construct arguments, counterarguments, and rebuttals (Landrieu et al., 2022).

Explicit instruction on writing strategies involves explicitly and systematically teaching students strategies for planning, writing, revising, and rewriting text (Graham & Perin, 2007a). The WWC model (Graham, 2018b) postulates that writers use different strategies to deal with limited cognitive capacity when writing. One of the most effective approaches (effect size of 0.82) to lower this cognitive load and to achieve higher writing outcomes, is explicitly teaching writing strategies (Bouwer et al., 2018; Graham, 2018b; Graham & Perin, 2007).

Explicit instruction not only provides a mechanism for enhancing students' argumentative writing performance, but prior research also demonstrated that it can have a positive impact on secondary school students' self-efficacy beliefs regarding writing (Bruning & Kauffman, 2016). Self-efficacy is defined as beliefs in the capability to successfully perform in a particular domain (Bandura, 2006), and students with a low sense of writing efficacy are likely to perform poorly when writing (Schunk, 2003). As a result, an important goal when teaching students how to write is to enhance their efficacy for writing, as self-efficacy for writing is an important predictor of writing performance (Graham et al., 2018). Given the importance of including self-efficacy for writing in educational research, self-efficacy for writing is therefore incorporated in the present study.

## Collaborative writing

Since the WWC model of Graham (2018b) emphasized that writing almost always involves multiple people, and therefore takes place within a writing community, collaborative writing provides opportunities for students to work together as they engage in a writing process (Graham, 2018b; Storch, 2005). A meta-analysis by Graham and Perin (2007a) demonstrated that collaborative writing can have a positive and substantial impact on the quality of secondary students' writing (effect size=0.75). This was illustrated in a study by Harlena and colleagues (2019), which found that collaborative writing improved not only secondary school students' writing, but also increased their involvement and their enthusiasm during the writing process.

Collaborating with peers is especially pertinent for argumentative writing in secondary education, since these students are able to engage quite well in effective and elaborate face-to-face argumentation (Felton & Herko, 2004). Additionally, as argumentation has a dialogic nature (Ferretti et al., 2000), the advantages of collaboration with peers in argumentative writing may even be greater than those gained in other genres (Cuevas et al., 2016; Ferretti & Lewis, 2013). Prior research has demonstrated that during collaborative writing students may combine different perspectives on a certain topic and therefore practice perspective taking with peers (Ferretti & Lewis, 2013; Schunk & Zimmerman, 2007). In their review, Bouwer and colleagues (2022) highlighted that collaborative writing supported students' learning from each other by talking and discussing with a peer, which ultimately helped students apply writing strategies. Therefore, collaborative writing was the second instructional approach that was incorporated in the present study.

Unfortunately, some students are not successful at working together and as a result require guidance and instruction to do so (Dillenbourg, 2002; Graham, 2018b; Thomas, 2013). According to Graham (2018b) and Morphy and Graham (2012), collaborative writing involves students working together to plan, write, revise, and rewrite their compositions. As Rummel and Spada (2005) indicated, successful collaboration should involve a balanced combination of individual and collaborative activities. They claim that there should be enough time for individual work allowing students to use and include their own individual knowledge to finish a task. In line with this, Scheuer and colleagues (2014) divided the collaborative, argumentative writing process into four different phases. Each phase of the process was predetermined as either collaborative or individual work: (a) individual preparation (i.e., individual reading and analysing source texts), (b) collaborative discussion on each of the source texts, (c) collaborative discussion of the relations (e.g., conflicts or agreements) between both source texts, and (d) collaboratively agreeing on a joint position and integrating that position in one joint text written by both authors. By guiding students through the different phases of individual and collaborative writing, a higher number of elaborative moves and a more positive learning process was achieved (Scheuer et al., 2014). This study elaborates on the study of Scheuer and colleagues (2014) by also dividing the collaboration process into four different phases, however, differently implemented. Multiple studies have examined the (dis)advantages of writing collaboratively versus individually during each phase of the writing process.

Below, we provide a review of these studies in writing and organize them according to writing processes.

## Planning

Studies comparing individual and collaborative planning have reported mixed results (McDonough & De Vleeschauwer, 2019). Research by Rahayu and colleagues (2020) reported positive results, as they found that collaborative planning was an effective method to use in writing classes to enhance writing performance and motivation. Further, a study by McDonough and De Vleeschauwer (2019) reported that planning collaboratively can result in better accuracy and complexity in students' written texts. However, that same study also reported that individual planning resulted in higher analytic ratings for writing quality. Because many students have difficulties with accuracy in their texts, at least some of the prior investigations support having students plan their texts collaboratively instead of individually (Landrieu et al., 2022; McDonough & De Vleeschauwer, 2019). This study incorporates these findings and enables students to plan their text collaboratively.

## Writing and rewriting

Storch (2005) found that pairs of students produced shorter but better texts in terms of task fulfilment, grammatical accuracy, and complexity than individual writers. However, these results were not statistically significant, probably because of the small sample of students ( $n=23$ ) included in the study. In contrast, Wigglesworth and Storch (2009) found that collaborative writing did improve text accuracy, but did not affect fluency and complexity of written texts. Given the mixed results in educational research, we explore both approaches (namely individual and collaborative writing and rewriting) in the present study.

## Revising

While revising can occur at any stage of the writing process, it often involves evaluating and determining what needs to be changed in a text. When students revise text together in a thoughtful manner, it can have multiple benefits, including preventing free-riding by one student (i.e., one student benefitting from the work of another student), improving communication between peers, and ultimately positively affecting the quality of the written text (Sridharan et al., 2018). Given the positive results in educational literature on collaboratively revising, this study has students revise their texts collaboratively.

## Inconsistency in educational research

At this point, it is still unclear during which phases of the writing process students should work collaborative and when they should work individually. Prior research by Wang and colleagues (2011) indicated that students who were combining collaborative and individual work reached higher learning outcomes than students who

worked individually. However, students who combined collaborative and individual work, reached lower learning outcomes than students who worked collaboratively throughout the whole learning process (Wang et al., 2011). A study by Hermann and colleagues (2001) found that, on the one hand, individual accountability and individual domain knowledge were essential for successful collaborative learning (Olsen et al., 2019; Slavin, 1989), but on the other hand, students who wrote collaboratively tended to make less errors, asked for less help than students who worked individually and benefitted more from fruitful discussions (Hausmann et al., 2008; Olsen et al., 2019).

### **Impact of collaborative writing on self-efficacy for writing**

Prior research indicated that collaborative writing can also have a positive impact on the self-efficacy of students (Bruning & Kauffman, 2016; De Bernardi & Antolini, 2007; Paquette, 2009) noted collaborative writing can strengthen self-efficacy for writing by (a) offering models for decision making, (b) exposing students to new perspectives on writing, and (c) providing greater chances for successful performance. Especially for argumentative writing, research of De Bernardi and Antolini (2007) pointed out the importance and usefulness of collaborative writing since the collaboration leads to higher intrinsic motivation, decreased anxiety about the activity, and a higher sense of self-efficacy for writing.

### **Complementarity of explicit instruction and collaborative writing**

Explicit instruction and collaborative writing are two instructional approaches that are both effective in enhancing students' argumentative writing performance and self-efficacy for writing (Ferretti & Lewis, 2013; Graham et al., 2016; Granado-Peinado et al., 2019b, 2022; Volet et al., 2009). However, only a few studies combining both instructional approaches are available. To date, we only located studies by Granado-Peinado and colleagues (2019b, 2022) (higher education), Elving and van den Bergh (2015) (secondary education), and De Smedt and colleagues (2018; 2020) (primary education), that examined the effectiveness of combining explicit writing instruction with collaborative writing. The study by Granado-Peinado and colleagues (2022) acknowledged the importance of combining both instructional approaches by (a) teaching students how to collaborate and (b) providing them explicit writing instruction to support their argumentative writing. The study of Elving and van den Bergh (2015) found that peer interaction in pre-writing (i.e., planning) and post-writing (i.e., revising) was more effective than individual writing throughout the entire writing process. This study indicated that even a short five-minute discussion with peers before and after writing, resulted in higher-quality texts (Elving & van den Bergh, 2015). De Smedt and colleagues (2018; 2020) found that integrating collaborative writing in explicit writing instruction programs in primary education was a promising approach, as students who wrote collaboratively outperformed students that wrote individually in terms of the quality of their written texts (De Smedt et al., 2018; 2020).

## The present study and research questions

Based on our review of the literature above, it is clear that we still know little about the effectiveness for secondary students of combining explicit instruction and collaborative writing. Most available studies investigated only one of these instructional approaches (often explicit writing instruction), but did not examine the combined effectiveness of the two approaches. The aim of this study was to (a) examine if combining these two approaches (i.e., explicit writing instruction and collaborative writing) was effective with secondary students and to (b) compare collaboration during all phases of the writing process with collaboration during some phases of the process (i.e., alternating between individual and collaborative writing). We followed the suggestion of Scheuer and colleagues (2014) to divide the writing process into four different phases, and to predetermine which phases were collaborative or individual work. We examined the impact of these approaches to writing argumentative essays on students' writing performance and self-efficacy for writing.

In this study, a cluster randomized control trial with two measurement occasions (i.e., pre- and post-test) was applied. The first research condition (EI+CW) involved explicit writing instruction in writing, and involved students writing collaboratively during all phases of the writing process. The second research condition (EI+CW/IW) involved explicit writing instruction as well, however, students were not collaborating throughout all phases of the writing process, but were alternating between collaborative and individual writing. The third research condition (MP+CW) was a matched practice condition, in which students received no explicit writing instruction, but were (like the EI+CW research condition) writing collaboratively throughout the whole writing process. For a detailed overview of the components of the three research conditions, see section "Instruments and Materials" and "Appendix B".

The following research questions were addressed:

RQ1: What is the effect of explicit instruction and collaborative writing on students' (a) individual argumentative writing performance and (b) self-efficacy for argumentative writing? Based on prior empirical research, we hypothesized better argumentative writing performance and a higher self-efficacy for writing when explicit instruction and opportunities for collaborative writing are provided (Bruning & Kauffman, 2016; Ferretti & Lewis, 2013; Graham et al., 2016; Granado-Peinado et al., 2019b).

RQ2: Are there differential effects of the explicit writing instruction when it is combined with (a) collaborative writing during all writing phases or with (b) an alternation between individual and collaborative writing? Only a few studies have studied alternating between individual and collaborative learning and writing (Rummel & Spada, 2005). Research of Wang and colleagues (2011) resulted in higher learning outcomes for students who combined collaborative and individual work, whereas research of Hermann and colleagues (2001) indicated the importance of individual accountability for successful collaborative learning. However, that study also indicated that students who wrote collaboratively tended to make less errors and asked for less help than students who worked individually. Due to these inconsistent findings, we refrain from formulating a hypothesis in any direction on the outcomes for this research question.



## Methodology

### Participants

In October 2020, an open call for participation was spread to secondary schools in Flanders (Belgium) who offer an academic track. The academic track provides general education to secondary school students, with the aim to continue studies in tertiary education. In total, ten teachers from five different schools (schools were randomly divided across three conditions) were selected to participate in this study. Teachers from the same school were always grouped in the same condition to avoid spill-over effects. Each teacher participated with one, two, or three classes, resulting in nineteen participating classes (see Table 1).

As to the participating students, the 19 classes including 400 eleventh and twelfth graders. The majority of the students, 83%, had Dutch (the language of instruction in Flanders, Belgium) as their only home language ( $n=332$ ), 7.5% of the students ( $n=30$ ) spoke a second language at home besides Dutch, and 7.1% of the students ( $n=28$ ) had another home language. Ten students were missing information on home language. 38% ( $n=152$ ) of the participants were male; 62% ( $n=248$ ) were female. Chi-square analyses indicated no significant differences in the distribution of home language ( $\chi^2=12.87$ ,  $df=10$ ,  $p=.231$ ) between the three conditions. However, a significant difference in the distribution of gender was found ( $\chi^2=10.69$ ,  $df=2$ ,  $p=.005$ ) as the MP+CW condition proportionally included more boys. However, boys and girls did not differ concerning writing performance ( $F=0.129$ ,  $df=1$ ,  $p=.720$ ), nor self-efficacy for writing (self-efficacy for argumentation:  $F=0.332$ ,  $df=1$ ,  $p=.565$ ; self-efficacy for regulation:  $F=0.277$ ,  $df=1$ ,  $p=.599$ ) at pretest.

Participating teachers averaged teaching 14.6 years ( $SD=11.90$ ). One-way analysis of variances did not indicate a significant difference between the three conditions regarding teachers' teaching experience ( $F=4.649$ ,  $df=2$ ,  $p=.052$ ).

**Table 1** Overview of Participating Schools, Teachers, and Students per Condition

Condition	Number of students per condition ( $n$ )	Participating schools ( $n$ )	Participating teachers ( $n$ )	Number of students per teacher ( $n$ )
EI+CW	117	School A	Teacher 1	45 (2 classes)
			Teacher 2	40 (2 classes)
			Teacher 3	32 (1 class)
EI+CW/IW	185	School B	Teacher 4	10 (1 class)
			Teacher 5	37 (2 classes)
		School D	Teacher 6	57 (3 classes)
			Teacher 7	71 (3 classes)
MP+CW	98	School E	Teacher 8	38 (2 classes)
			Teacher 9	43 (2 classes)
			Teacher 10	17 (1 class)
Total	400	5	10	400 (19 classes)

*Note.* EI+CW=explicit writing instruction+collaborative writing during all phases; EI+CW/IW=explicit writing instruction+alternating between collaborative and individual writing; MP+CW=matched practice (no explicit instruction)+collaborative writing during all phases



## Instruments and materials

### Intervention programs: components

A cluster randomized control trial (CRT) design was applied. Central to this design was the random assignment of units (i.e., schools in the present study) to treatment conditions. Table 1 showed the assignment to the research conditions, whereas Table 2 provided an overview of the research conditions, which are described in detail below.

**Explicit writing instruction + collaborative writing during all phases (EI + CW)** The EI + CW research condition was characterized by (a) explicit writing instruction (i.e., explicit instruction on writing knowledge regarding writing argumentative texts and explicit instruction on writing strategies) and (b) collaborative writing during all phases of the writing process (e.g., planning, writing, revising, and rewriting).

Explicit instruction on writing knowledge regarding argumentative texts included (a) information on what an argumentative text is, (b) information on the goal of an argumentative text, (c) information on the structure of an argumentative text, and (d) information on how to formulate strong (counter)arguments and rebuttals. Explicit instruction on writing strategies included instruction on the writing process itself: how to plan, write, revise, and rewrite argumentative texts (Harris et al., 2006). In the EI + CW research condition, pairs wrote one joint text. All explicit instruction on writing knowledge regarding argumentative texts and explicit instruction on writing strategies was summarised in an argumentation guide and a knowledge video-clip. Teachers stimulated students to gradually diminish the use of the argumentation guide in view of internalizing the writing knowledge and strategies. During the eight

**Table 2** Overview of the Interventions Programs

	Intervention programs		
	EI + CW	EI + CW/IW	MP + CW
Instructional approaches			
Explicit writing instruction:	x	x	x
Explicit instruction on writing knowledge regarding writing argumentative texts	x	x	x
Explicit instruction on writing strategies (i.e., planning, writing, revising, and rewriting)	x	x	
Collaborative writing			
Pairing students			
Collaborative writing throughout all phases			
Alternating between individual and collaborative writing (collaborative planning; individual writing; collaborative revising; individual rewriting)			
Writing lesson programs Materials and Procedure			
Teacher manual and writing materials provided by the researchers	x	x	x
8 lessons of 50 min	x	x	x
List of potential writing topics (including 2 source texts per topic)	x	x	
Use of the argumentation guide and knowledge videoclip			

lessons on argumentative writing, students in the EI+CW research condition were writing collaboratively throughout all phases of the writing process. Students were instructed not to divide the work and to strive to write qualitative argumentative texts, that meet the predetermined requirements. More information on the key elements of the intervention study, can be found in Appendix B.

**Explicit writing instruction + alternating between collaborative and individual writing (EI+CW/IW)** The EI+CW/IW condition received identical explicit writing instruction as the EI+CW condition. The main difference between the EI+CW and EI+CW/IW research condition lays in the collaboration. In the EI+CW condition, students are going through all phases of the writing process collaboratively, whereas in the EI+CW/IW condition, students are alternating between collaborative and individual work. Since research on planning and revising collaboratively is mostly positive and since Rummel and Spada (2005) pointed out that there should be alternation between individual and collaborative work during writing, it was chosen in this present study to let students plan and revise together with a peer, and to let students write and rewrite individually. This implied that each individual student wrote an individual text, whereas in the EI+CW research condition, one joint text per pair was written.

**Matched practice research condition + collaborative writing throughout all phases (MP+CW)** In the MP+CW condition, students did not receive any explicit instruction, but did receive ample writing opportunities with the same argumentative writing topics and source texts used in the other research conditions. Whenever students in the EI+CW and EI+CW/IW research condition received explicit instruction on argumentative writing, students in the MP+CW research condition received replacement exercises on argumentative writing (e.g., write a persuasive letter to Netflix), but without any explicit writing instruction. Students were asked to write collaboratively throughout the whole writing process (similar to the EI+CW condition), resulting in one joint text per pair. This condition was included in the present study to explore whether students would benefit from collaborative writing argumentative texts during all phases of the writing process, without explicit writing instruction of argumentative writing knowledge and without explicit instruction on writing strategies.

### Pairing students

Regardless of the research condition, students were paired based on their writing performance. Teachers were asked to pair students and were given the following instructions: “divide the class into four groups, based on an estimation of the writing performance of the students (level 1: weakest writers, level 2: low to average writers, level 3: average to strong writers, and level 4: very strong writers). Pair students from level 1 with level 2 students, level 2 with level 3 students and level 3 students with level 4 students (to the extent possible of course, as not all levels included the same number of students).“ Prior research revealed that less-experienced writers often learn more when they are writing together with a slightly more experienced peer

(Shafie et al., 2010). If a dyad consisted of students with clashing personalities, the teacher adjusted the pairing procedure. In case of an uneven number of students, one group of three students was formed.

### Argumentative writing lessons

Teachers in all research conditions received a teacher manual and writing material from the researchers, including eight lessons of approximately 50 min. Also a list of potential writing topics was provided (e.g., the use of smartphones at school; vaping is less damaging than smoking; raising the age limit of alcohol consumption to 18 years [instead of 16 years in Belgium]; banning animal testing for cosmetics). Students were free to choose topics, according to their own interest. For each topic, two informative source texts were provided, that included both pro as contra arguments on each topic. The source texts that were used, were identical for all research conditions. Since all texts were authentic, their length was somewhat different, however, they had similar difficulty levels.

During the eight consecutive lessons, many writing opportunities were provided for students to internalize the genre knowledge and the writing strategies. Two types of lessons were developed: (a) explicit instruction lessons and (b) practice lessons with collaborative writing. Table 3 provides an overview of the eight lessons, per research condition.

### Argumentative writing test

During pre- and post-test, students completed an argumentative writing test based on two informative source texts (Landrieu et al., 2022). The topic for the pre-test was “voting rights from the age of 16” and during the post-test students wrote about “the conservation of zoos”. Students were instructed to clearly take a position and to

**Table 3** Overview of Argumentative Writing Lessons

Lesson	EI+CW and EI+CW/IW	MP+CW
1	Introduction to argumentative writing	Introduction to argumentative writing
2	Instruction lesson: Planning	Practice lesson: Completing an entire writing process
3	Instruction lesson: Writing Practice lesson: Exercise on planning and writing an argumentative text	Instruction lesson: How to search for informative source texts. Practice lesson: exercise
4	Practice lesson: Oral debating in class Instruction lesson: Revising	Practice lesson: Completing an entire writing process
5	Instruction lesson: Rewriting Practice lesson: Exercise on planning and writing	Practice lesson: Completing an entire writing process
6	Practice lesson: Exercise on writing and revising	Practice lesson: Writing a persuasive letter to Netflix
7	Practice lesson: Exercise on rewriting	Practice lesson: Writing a persuasive letter to get vaccinated against Covid-19
8	Practice lesson: Completing an entire writing process	Practice lesson: Completing an entire writing process

defend that position to persuade readers. They received 45 min to complete their text. In total, 756 texts were collected and evaluated (pre-test:  $n=390$ ; post-test:  $n=366$ ). Respectively 10 and 34 students were absent during the pre- and post-test administration. The texts written by the students were scored by means of a benchmark rating procedure. In benchmark rating, raters are provided with benchmark texts that each represent a certain text quality, ranging from low to high quality (Bouwer et al., in review). The selection of five benchmark texts (with a standardized z-score of -2, -1, 0, 1 and 2) was based on previous research of Landrieu and colleagues (2022), that based the benchmarks on a scale with a reliable rank order (Separation Scale Reliability=0.83). The score of the benchmark text with average text quality was 100 and the interval between benchmarks was 15 (for more information, see De Smedt and colleagues, 2020 and Landrieu and colleagues, 2022). After two assessment trainings of approximately four hours in total, four trained raters evaluated all texts, by comparing the texts to the five benchmark texts. In view of calculating interrater reliability, 65 texts (9.2%) were double scored by the raters. The texts were randomly selected across conditions ( $n=14$  from the EI+CW condition,  $n=33$  from the EI+CW/IW condition,  $n=18$  from the MP+CW condition) and across both measurement occasions ( $n=33$  pre-test texts;  $n=32$  post-test texts). The Intraclass Correlation Coefficient (ICC) of the ratings was examined based on the two-way mixed model, measuring consistency between raters. The ICC was 0.720, indicating a moderate to good reliability.

### Reading comprehension test

Prior research indicated that reading and writing skills are strongly related (Shanahan, 2019).

In the present study, the relationship between reading and writing was especially important since informative source texts were used. To take into account secondary school students' reading comprehension skills, a method-independent and valid reading comprehension test, Diatekst, was administered to control for students' reading performance (Diattoetsen, z.d.).

### Self-efficacy for writing

The Self-Efficacy for Writing Scale (SEWS) (Bruning et al., 2013) was adjusted to the genre of argumentative writing. The original SEWS distinguishes self-efficacy for ideation (e.g., "I can think of many ideas for my writing"), self-efficacy for conventions (e.g., "I can write complete sentences"), and self-efficacy for regulation (e.g., "I can avoid distractions while I write) with 16 items on a 100-point scale (Bruning et al., 2013). In view of adjusting the instrument to the context of argumentative writing, *self-efficacy for ideation* was adapted to *self-efficacy for argumentation*, as was previously done by De Smedt and colleagues (2022). See Appendix for the adaptations that were made to this subscale. The subscale self-efficacy for convention was not included in the present study, since the focus of this subscale (e.g., on punctuation) does not align with the focus of the intervention.

Confirmatory factor analyses (CFA) indicated that the fit of the subscales self-efficacy for argumentation and self-efficacy for regulation was good in the present sample ( $\chi^2(42)=148.904$ ,  $p<.001$ , CFI=0.925, RMSEA=0.105, SRMR=0.054). CFI points to a good fit with values above 0.90 or 0.95 (Jackson et al., 2009; Little, 2013). Values closer to 0 represent a good fit for RMSEA, ideally less than 0.07, however 0.105 is still an acceptable value (Steiger, 2007). Values lower than 0.08 are aspired for SRMR (Hu & Bentler, 1999). The reliabilities of the subscales were good (Cronbach's  $\alpha=0.904$  for argumentation and  $\alpha=0.856$  for regulation).

## Procedure

Figure 1.

Throughout the data collection, a stepwise procedure was applied. After the professionalisation in December 2020, pre-tests (February 2021) and post-tests (May 2021) were administered by the lead author and two trained research assistants. The intervention took place between pre- and post-test. An active informed consent was obtained from all students. All parents received a passive informed consent form as they were offered the opportunity to withdraw their child from participation.

## Training of teachers

**Content of the training** Regardless of the research condition, all teachers received a training of approximately two to three hours. During the training, the goals and the aim of the study, as well as more practical information was provided. Teachers in the EI+CW and EI+CW/IW condition received explicit instruction on how to teach writing knowledge regarding argumentative writing and how to teach explicit instruction on writing strategies (see Appendix B for more information). Teachers from the MP+CW research condition, did not receive any information on how to implement explicit writing instruction in their writing classes. Additionally, teachers were informed on how their students should be collaborating (collaboratively throughout all phases of the writing process for the EI+CW and MP+CW research conditions, and alternating between collaborative and individual writing for the EI+CW/IW research condition; see Appendix B for more information).

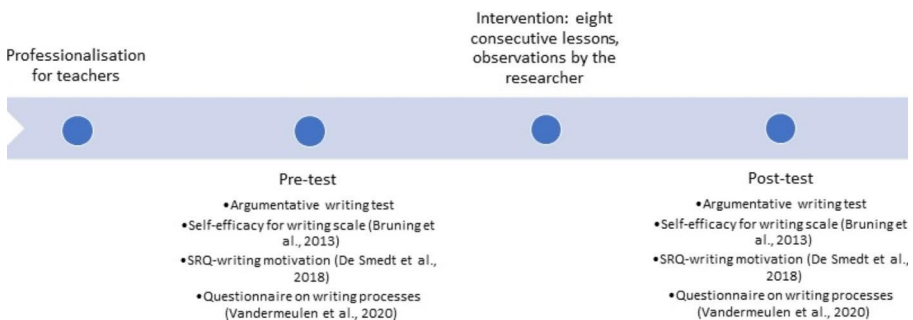


Fig. 1 overview of the data collection

**Materials used during teacher training** Teachers were taught how to use the condition-specific teacher manuals and materials (e.g., PowerPoint-presentations, the argumentation guide, the knowledge videoclip and the Google Documents of the students).

### Fidelity of implementation

The lead author and two trained research assistants observed two lessons of each participating teacher ( $n=10$ ), resulting in 20 observations. An observation checklist based on De Smedt and colleagues (2020) and Vaughn and colleagues (2011) was used. The observation checklist focused on (a) time spent on on/off-task teacher activities, (b) the quality of teachers' implementation of the intervention on a 5-point Likert scale ranging from score 1=very low to score 5=very high quality, and (c) a global evaluation of the observed lesson (i.e., instructional qualities of the teacher, classroom management, and student involvement) using a 5-point Likert scale ranging from score 1=very low to score 5=very high evaluation.

Observations indicated that teachers spent, on average, 44.8 min ( $SD=3.95$ ) on the lessons which approximates the recommended time of 45–50 min per lesson. Time spent does not differ significantly between conditions ( $F=2.39$ ,  $df=2$ ,  $p=.162$ ). Teachers were on task on average 79.60% of the observed lesson time. However, there was a significant difference between conditions ( $F=6.50$ ,  $df=2$ ,  $p=.025$ ). EI+CW/IW teachers spent less time on task than teachers in both other conditions. This was mainly due to one teacher's off-task behaviour. Students' post-test writing results of that specific teacher were, however, not significantly different from the other students within the same research condition ( $p<.001$ ) (test results from off-task teacher:  $M=101.29$ ;  $SD=16.51$ ; post-test results from other teachers in EI+CW/IW condition:  $M=99.13$ ;  $SD=16.02$ ).

Regarding the quality of teachers' implementation of the intervention, we can conclude that teachers integrated the key elements of this intervention study quite well and similar to each other as we, the researchers, had intended (measured on a 5-point Likert scale ranging from score 1=not implemented to score 5=very well implemented) (EI+CW:  $M=3.73$ ,  $SD=1.59$ ; EI+CW/IW:  $M=3.74$ ,  $SD=1.97$ ; MP+CW:  $M=3.92$ ,  $SD=1.15$ ).

Regarding global quality of the observed lessons, fidelity results show that (a) the instruction of the observed lessons was strong (EI+CW:  $M=4.33$ ,  $SD=0.58$ ; EI+CW/IW:  $M=3.75$ ,  $SD=0.65$ ; MP+CW:  $M=4.67$ ;  $SD=0.58$ ), (b) class management was good (EI+CW:  $M=4.67$ ,  $SD=0.58$ ; EI+CW/IW:  $M=3.50$ ,  $SD=0.71$ ; MP+CW:  $M=4.33$ ,  $SD=0.29$ ), and (c) students engaged well during the lessons (EI+CW:  $M=4.50$ ,  $SD=0.50$ ; EI+CW/IW:  $M=4.63$ ,  $SD=0.25$ ; MP+CW:  $M=4.00$ ,  $SD=0.00$ ). No significant differences between conditions were found (quality of instruction ( $F=2.06$ ,  $df=2$ ,  $p=.20$ ); class management ( $F=3.85$ ,  $df=2$ ,  $p=.08$ ) and student engagement ( $F=3.63$ ,  $df=2$ ,  $p=.08$ )).

## Data analysis

To investigate the effect of the intervention on students' writing performance and self-efficacy for writing, multilevel analyses were performed in MLwiN 2.29. A three-level null model was initially computed for each post-test response variable to take into account the nesting of students (i.e., level 1) grouped in dyads (i.e., level 2) within classes (i.e., level 3). Since the variance between dyads was not significantly different from zero ( $\chi^2=0.823$ ,  $df=1$ ,  $p=.364$ ), we decided to proceed with multilevel analyses on two levels (level 1: students; level 2: classes).

Two-level null models were subsequently constructed for each post-test response variable (i.e., writing performance, self-efficacy for argumentation, and self-efficacy for regulation). The intercepts in the fixed part of the null models represent the overall mean of each response variable for all students in all classes. In the random part of the null models, the variances at class level are significantly different from zero which indicates the importance of including two levels in the analyses and therefore justifying the use of multilevel analyses. After constructing the null models, Model 1 was constructed by adding multiple predictors to the null model (i.e., gender, reading comprehension, and pre-test scores). We opted for retaining predictors in the model as long as the model fit improved (regardless of the predictor was significant or not). For Model 2, the research conditions were added to the model. Finally, to obtain a better understanding of the relative impact of the significant parameters, standardized regression coefficients were calculated.

## Results

### Descriptive statistics

Table 4 displays the descriptive statistics at pre- and post-test for all variables. Table 5 displays the correlations between these variables. There is a moderate (but significant at  $p<.01$  level) correlation between students' argumentative writing performance during pre-test and post-test. Higher correlations were found between students' self-efficacy during pre-test and post-test (ranging from  $r=.564$  to  $r=.704$ ).

**Table 4** Descriptives for all Study Variables according each Research Condition

	EI+CW <i>M (SD)</i>	EI+CW/IW <i>M (SD)</i>	MP+CW <i>M (SD)</i>
Writing performance pre-test	85.920 (13.089)	85.679 (16.398)	81.832 (13.206)
Writing performance post-test	101.995 (13.795)	99.832 (16.161)	81.436 (16.494)
Self-efficacy for argumentation pre-test	66.395 (11.982)	66.355 (13.223)	62.681 (12.944)
Self-efficacy for argumentation post-test	74.646 (10.711)	73.465 (11.512)	66.567 (12.902)
Self-efficacy for regulation pre-test	63.440 (16.872)	63.511 (17.847)	59.306 (18.203)
Self-efficacy for regulation post-test	70.229 (16.574)	68.627 (16.731)	61.440 (18.295)



**Table 5** Correlations for all Study Variables

	(1)	(2)	(3)	(4)	(5)
(1) Argumentative text quality (pre-test)	0.218**	0.016	0.564**	0.420**	0.659**
(2) Argumentative text quality (post-test)	-0.030	0.164**	0.504**	0.591**	
(3) Self-efficacy for argumentation (pre-test)	0.023	0.085	0.389**		
(4) Self-efficacy for argumentation (post-test)	-0.045	0.196**			
(5) Self-efficacy for regulation (pre-test)	0.042				
(6) Self-efficacy for regulation (post-test)					

Note. \*\*\* $p < .001$ . \*\* $p < .01$ . \* $p < .05$

**Table 6** Summary of the Model Estimates for the Two-level Analysis of Students' Argumentative Writing Performance at Post-test

	Model 0	Model 1	Model 2 <sup>a</sup>
Fixed part			
Intercept	95.764 (2.29)***	92.728 (2.143)***	81.081 (2.154)***
Gender (girl)		5.729 (1.678)***	5.220 (1.644)**
Pre-test writing test score – 85 <sup>B</sup>		0.174 (0.056)**	0.171 (0.054)**
Reading comprehension test score – 90 <sup>B</sup>		0.234 (0.086)**	0.228 (0.081)**
EI+CW			16.909 (2.690)***
EI+CW/IW			15.572 (2.462)***
Random part			
class-level variance	86.598 (32.229)**	54.114 (21.643)*	6.041 (5.703)
student-level variance	231.363 (17.566)***	206.766 (16.190)***	206.077 (16.121)***
Model fit			
Loglikelihood	3070.530	2851.032	2825.313
$\chi^2$		219.50	26.000
$df$		3	2
$p$		<0.001	<0.001
Reference Model		Model 0	Model 1

Note. <sup>A</sup> Model equation with MP+CW condition as reference condition as an example; <sup>B</sup> Centred around mean

\*\*\* $p < .001$ . \*\* $p < .01$ . \* $p < .05$

## Multilevel results

Tables 6, 7 and 8 present the summaries of the model estimates in the multilevel analysis of students' post-test of (a) argumentative writing performance (Table 6), (b) self-efficacy for argumentation (Table 7), and (c) self-efficacy for regulation (Table 8).

### Argumentative writing performance

Model 2 has a better fit than model 1 ( $\chi^2=26.000$ ,  $df=2$ ,  $p < .001$ ), which has a better fit than the null model ( $\chi^2=219.50$ ,  $df=3$ ,  $p < .001$ ). After controlling for students'

**Table 7** Summary of the Model Estimates for the Two-level Analysis of Students' Self-efficacy for Argumentation at Post-test

	Model 0	Model 1	Model 2 <sup>a</sup>
<b>Fixed part</b>			
Intercept	72.103 (1.089)***	72.312 (0.819)***	68.343 (1.274)***
Pre-test self-efficacy for argumentation score – 65 <sup>B</sup>		0.485 (0.041)***	0.482 (0.040)***
Reading comprehension test score – 90 <sup>B</sup>		0.156 (0.054)**	0.136 (0.052)**
Pre-test WritingTest score – 85 <sup>B</sup>		0.018 (0.037)	0.012 (0.037)
EI+CW			5.788 (1.728)***
EI+CW/IW			5.050 (1.589)**
<b>Random part</b>			
class-level variance	15.685 (7.361)*	7.616 (4.122)	2.426 (2.401)
student-level variance	129.513 (9.731)***	89.578 (6.982)***	89.490*** (6.971)
<b>Model fit</b>			
Loglikelihood	2895.578	2569.471	2559.123
$\chi^2$		326.11	10.349
<i>df</i>		3	2
<i>p</i>		<0.001	0.006
Reference Model		Model 0	Model 1

Note. <sup>A</sup>Model equation with MP+CW condition as reference condition as an example; <sup>B</sup>Centred around mean

\*\*\* $p < .001$ . \*\* $p < .01$ . \* $p < .05$

gender, pre-test writing, and reading comprehension performance, the results in Table 6 show that the students in the EI+CW condition ( $\chi^2=39.503$ ,  $df=1$ ,  $p < .001$ , effect size=0.956) and EI+CW/IW condition ( $\chi^2=40.017$ ,  $df=1$ ,  $p < .001$ , effect size=0.881) outperform MP+CW students at the post-test for argumentative writing. No significant differences between the EI+CW and the EI+CW/IW condition were found ( $\chi^2=0.338$ ,  $df=1$ ,  $p = .561$ ).

### Self-efficacy for argumentation

Model 2 has a better fit than model 1 ( $\chi^2=10.349$ ,  $df=2$ ,  $p = .006$ ), which has a better fit than the null model ( $\chi^2=326.11$ ,  $df=3$ ,  $p < .001$ ). After controlling for students' pre-test self-efficacy for argumentation, writing performance, and reading comprehension, the results in Table 7 indicate that students from the EI+CW ( $\chi^2=11.220$ ,  $df=1$ ,  $p < .001$ , effect size=1.499) and EI+CW/IW condition ( $\chi^2=10.102$ ,  $df=1$ ,  $p = .001$ , effect size=1.356) report a higher self-efficacy for argumentation at post-test compared to MP+CW students. No significant differences between the EI+CW and EI+CW/IW condition ( $\chi^2=0.249$ ,  $df=1$ ,  $p = .612$ ) were found.

**Table 8** Summary of the Model Estimates for the Two-level Analysis of Students' Self-efficacy for Regulation at Post-test

	Model 0	Model 1	Model 2 <sup>a</sup>
<b>Fixed part</b>			
Intercept	67.433 (1.285)***	67.064 (0.849)***	63.438 (1.497)***
Pre-test self-efficacy for regulation score -62 <sup>B</sup>		0.637 (0.040)***	0.628 (0.039)***
Reading comprehension test score -90 <sup>B</sup>		0.152 (0.070)*	0.135 (0.069)*
Pre-test Writing Test score -85 <sup>B</sup>		0.055 (0.049)	0.051 (0.049)
EI+CW			5.613 (2.008)**
EI+CW/IW			4.284 (1.868)*
<b>Random part</b>			
class-level variance	16.388 (10.165)	4.558 (4.426)	1.098 (3.230)
student-level variance	285.635 (21.464)***	163.068 (12.706)***	162.129 (12.621)***
<b>Model fit</b>			
Loglikelihood	3181.919	2768.129	2760.555
$\chi^2$		413.79	7.574
<i>df</i>		3	2
<i>p</i>		<0.001	0.022
Reference Model		Model 0	Model 1

Note. <sup>a</sup> Model equation with MP+CW condition as reference condition as an example; <sup>B</sup>Centred around mean

\*\*\* $p < .001$ . \*\* $p < .01$ . \* $p < .05$

### Self-efficacy for regulation

Model 2 has a better fit than model 1 ( $\chi^2=7.574$ ,  $df=2$ ,  $p=.022$ ), which has a better fit than the null model ( $\chi^2=413.79$ ,  $df=3$ ,  $p<.001$ ). After controlling for students' pre-test self-efficacy for regulation, writing performance, and reading comprehension, Table 8 indicates that there is a significant difference between the EI+CW and MP+CW condition ( $\chi^2=7.813$ ,  $df=1$ ,  $p=.005$ , effect size=1.018) and between the EI+CW/IW and MP+CW condition ( $\chi^2=5.262$ ,  $df=1$ ,  $p=.022$ , effect size=0.919). No statistically significant differences were found between the EI+CW and the EI+CW/IW condition ( $\chi^2=0.607$ ,  $df=1$ ,  $p=.435$ ).

### Discussion

This paper investigated the importance of explicit writing instruction and collaborative writing on (a) argumentative writing performance and (b) self-efficacy for writing of secondary school students. This study additionally aimed to evaluate the effectiveness of alternating between individual and collaborative writing throughout the writing process.

## Impact of explicit instruction and collaborative writing on writing performance

First, the results indicated that there is a large (effect size  $\geq 0.8$ , Cohen, 1977) significant effect of explicit writing instruction and collaborative writing for both the EI+CW and EI+CW/IW research condition on students' argumentative writing performance, which confirmed the first hypothesis of the present study. This was in line with prior studies by Ferretti and Lewis (2013), Graham and colleagues (2016), Granado-Peinado and colleagues (2019a), and Van Drie and colleagues (2018) who championed the importance of explicit writing instruction to achieve higher argumentative writing outcomes. In the present study, explicit writing instruction in both the EI+CW and EI+CW/IW conditions was conceptualized as a combination of (a) explicit instruction on writing knowledge regarding writing argumentative texts and (b) explicit instruction on writing strategies. Students learned how to compose and structure an argumentative text (e.g., how to include counterarguments and rebuttals), but also received instruction on the different phases of the writing process (i.e., planning, writing, revising, and rewriting), which led to higher writing performance. In contrast, students in the matched practice research condition (MP+CW) achieved lower scores than students from both the EI+CW and EI+CW/IW research conditions. This study indicated that students not only need ample collaborative writing opportunities, they additionally benefit from explicit writing instruction in which they are taught how to write argumentative texts.

## Impact of explicit instruction and collaborative writing on self-efficacy for writing

As to students' self-efficacy beliefs, the results of this study indicated that providing explicit writing instruction and enabling students to write collaboratively, positively affected self-efficacy for argumentation and self-regulation. The positive effect on students' self-efficacy for argumentation is likely due to the provided explicit instruction on writing knowledge regarding writing argumentative texts. Students were explicitly taught how to construct an argumentative text and what elements should be included (e.g., arguments, counterarguments, and rebuttals), which may have led to improved self-efficacy for argumentation. The positive effect on self-efficacy for regulation can be connected to the fact that students gained confidence to successfully direct themselves through the writing process (Bruning et al., 2013). Students were supported in how to plan, write, revise, and rewrite an argumentative text and, therefore, this intervention likely helped students to form a more positive belief in their competence in starting and continuing to keep writing even though it is difficult. Additionally, by providing a pre-writing (i.e. planning) and post-writing (i.e. rewriting) phase in the writing process, students likely reflected on their writing goals and progress (see Bruning et al., 2013). This is in line with the WWC model (Graham, 2018b), claiming that if students believe they are good writers, their writing performance can be enhanced. In this respect, it would also be relevant for further research to test these assumptions (e.g., by interviewing the students on how the intervention affected their self-efficacy for writing).

## Differential effects of alternating between collaborative and individual writing

Throughout the years, writing has often been perceived as a solitary task. However, this point of view was challenged by the WWC model (Graham, 2018b; Storch, 2019). Multiple studies have pointed out the usefulness of collaborative writing in the classroom (Bouwer et al., 2022; Graham & Perin, 2007; Harlena et al., 2019). Unfortunately, it remains unclear whether students benefit most from collaborating throughout the complete writing process or from alternating between collaborative and individual writing phases. On the one hand, research of Graham and Perin (2007) and Harlena and colleagues (2019) indicated that writing collaboratively throughout all phases of the writing process was very effective and increased writing performance. On the other hand, research of McDonough and De Vleeschauwer (2019), Rahayu and colleagues (2020), Sridharan and colleagues (2018), Rummel and Spada (2005), and Storch (2005) pointed out the importance of alternating between collaborative and individual writing. Rummel and Spada (2005) suggested that alternating between collaborative and individual writing could lead to successful collaboration. It remains, however, unclear how this should be effectively implemented during collaborative writing.

Prior educational research noted that it is crucial to establish a well-balanced proportion between individual and collaborative work (Hermann et al., 2001; Olsen et al., 2019; Scheuer et al., 2014; Wang et al., 2011). As Olsen and colleagues (2019) indicated: “*it is not just a combination [between collaborative and individual learning] that is important, but to understand what combinations of collaborative and individual learning can be effective for learning and when*” (Olsen et al., 2019, p. 377). Based on educational research of McDonough and De Vleeschauwer (2019), Rahayu and colleagues (2020), Sridharan and colleagues (2018), and Storch (2005), alternating between collaborative and individual writing could lead to higher writing performance and self-efficacy for writing. However, the results from the current study did not corroborate these prior studies. Multiple factors might explain this.

First, switching between collaborative and individual writing in the EI+CW/IW research condition might have taken additional time that could be better spent in explicit writing instruction in the EI+CW research condition. Research by Olsen and colleagues (2019) pointed out that the transition between collaborative and individual learning took time that otherwise could have been spent on instruction and therefore could have led to lower learning outcomes (Olsen et al., 2019). Closely monitoring how much time is spent on instruction (through video analyses on what happens in the classroom) in both research conditions would have had an added value in this study. For further research, it would also be beneficial to verify how alternating between collaborative and individual writing can be optimised and further investigated. The present study made an attempt in this respect, by choosing for individual planning, collaborative writing, individual revising and collaborative rewriting. However, other operationalisations such as planning collaboratively and writing, revising and rewriting individually need to be further explored.

Second, there might be too many similarities between the EI+CW and EI+CW/IW research conditions as implemented in the present study. The main difference between both conditions was the way collaboration was formed (collaborative writ-

ing throughout all writing phases in the EI+CW research condition, and alternating between individual and collaborative writing in the EI+CW/IW research condition). The provided explicit writing instruction was identical in the EI+CW and EI+CW/IW research condition. Since providing explicit writing instruction already had a large impact on the argumentative writing performance of the students, maybe alternating between collaborative and individual writing did not make an additional difference.

Another similarity between the two research conditions can be found in the pre-writing phase, where students were asked to plan their text collaboratively. The teachers asked the students to take one shared point of view (e.g., pro or contra voting rights from the age of 16) and to think about arguments to defend that position and to persuade a reader. This could be a limitation of this study. We asked students to take in one shared point of view, without checking students' point of views in advance. This might have had an impact on the writing performance of students, since they felt obligated to follow the opinion of their peer. However, no differences in writing performance and self-efficacy for writing were found between both research conditions. Writing performance and self-efficacy for argumentative writing may be improved if all students (including writing within pairs) can take their own point of view, instead of a shared point of view. Future research could also ask students' point of view before they start planning their argumentative text. Maybe students with different opinions experience more difficulties in reaching agreement during the planning phase, which could influence the quality of their written texts? In their study, Scheuer and colleagues (2014) intentionally paired up students with conflicting opinions. Conflicting opinions demand collaborative conflict resolution wherein students need to consider different point of views, which could lead to higher learning outcomes, also confirmed by Nussbaum (2008).

Third, students in the EI+CW condition went through all phases of the writing process collaboratively, resulting in one argumentative text per pair. Students in the EI+CW/IW condition planned and revised their texts collaboratively, but wrote texts individually, resulting in two argumentative texts per pair. Given that no differences between both conditions were found, this may suggest that both approaches are equally effective. Future research should investigate more in depth the effectiveness of collaborative writing in which pairs plan and write the same text or in which pairs plan collaboratively but each produce their own text. It would also be interesting and useful to investigate how a writing task should ideally be constructed in order to enhance effective collaboration between students. As Thomas (2014) noted, a well developed task that ensures students are required to use their individual knowledge and therefore also their individual accountability is crucial for good collaboration. This could be stimulated by providing each student with a different informative source text that they have to process individually.

### **Limitations and suggestions for future research**

Through this study, we tried to gain more insight into the effectiveness of collaborative writing throughout the whole writing process, as well as when students alternate between collaborative and individual writing (planning collaboratively, writing individually, revising collaboratively, and rewriting individually). More in-depth

research into the quality of collaboration is needed to gain insight into the interaction processes and writing processes that take place during collaborative writing. In this respect, future studies might map how dialogue between students is formed throughout all phases of the writing process (e.g., by using screencast software, video and audio recordings, etc.). Since only a limited number of studies are available on how to alternate between collaborative and individual writing, further research on how to gain insight into what works best with the intention to inspire future classroom practice, is called for.

In addition to the above discussed limitations of the study design, it must be acknowledged that in view of calculating interrater reliability only 9.2% ( $n=65$ ) of the written texts were double scored. This can be considered as a relatively low percentage and therefore as a limitation of the study. Nevertheless, it has to be taken into account that double scoring 65 texts is still a substantial large amount of texts given the large data collection.

Finally, we can conclude that research on collaboration remains inconsistent and further studies on collaborative writing or alternating between collaborative and individual writing is therefore called for. However, our study did indicate that explicit writing instruction during collaborative, argumentative writing achieved a large impact on secondary school students' writing performance and self-efficacy for argumentative writing. This should be central in each writing intervention, since students do not automatically seem to master these writing skills (Thomas, 2013).

## Appendix A

*Adaptations made to Self-Efficacy for Writing (adapted from Bruning et al., 2013).*

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### Self-efficacy for Argumentation

Original items from self-efficacy for ideation (Bruning et al., 2013)	Adapted items from self-efficacy for argumentation (this present study)
<ol style="list-style-type: none"> <li>1. I can think of many ideas for my writing.</li> <li>2. I can put my ideas into writing.</li> <li>3. I can think of many words to describe my ideas.</li> <li>4. I can think of a lot of original ideas.</li> <li>5. I know exactly where to place my ideas in my writing.</li> </ol>	<ol style="list-style-type: none"> <li>1. I can think of many arguments I can write about.</li> <li>2. I can write my arguments into a text.</li> <li>3. I can think of many words to write down my arguments.</li> <li>4. I can think of many substantiated arguments to write about.</li> <li>5. I can put my arguments in the right place in a text.</li> </ol>

### Self-efficacy for Regulation

Original items from self-efficacy for regulation (Bruning et al., 2013)	(No adaptations to this subscale were made)
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Self-efficacy for Argumentation

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1. I can focus on my writing for at least one hour.
2. I can avoid distractions while I write.
3. I can start writing assessments quickly.
4. I can control my frustration when I write.
5. I can think of my writing goals before I write.
6. I can keep writing even when it's difficult.

Self-efficacy for Convention

This subscale was not included in this present study

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## Appendix B

### *Key ingredients of the intervention study.*

Key components of the intervention study	Operationalisation of the key components
Research condition EI+CW  1. Explicit instruction of writing knowledge regarding argumentative texts	<ul style="list-style-type: none"> <li>• What is an argumentative text?</li> <li>• What is the goal of an argumentative text?</li> <li>• How is an argumentative text structured? Which components (e.g., point of view, arguments, counterarguments, rebuttals) should be included in an argumentative text?</li> <li>• How to formulate strong (counter)arguments and rebuttals?</li> </ul>

Key components of the intervention study	Operationalisation of the key components
2. Explicit instruction on writing strategies	<ul style="list-style-type: none"> <li>• How to plan a text?               <ul style="list-style-type: none"> <li>o 1. Reading the source texts</li> <li>o 2. Searching for (counter)arguments</li> <li>o 3. Taking a point of view</li> <li>o 4. Thinking about refuting counterarguments</li> </ul> </li> <li>• How to write a text?               <ul style="list-style-type: none"> <li>o Ensuring a good structure of an argumentative text (see explicit instruction on writing argumentative texts)</li> <li>o Aid of sentence starters</li> </ul> </li> <li>• How to revise a text (detecting overall text quality)?               <ul style="list-style-type: none"> <li>o Evaluating multiple aspects of texts (by means of a provided evaluation rubric)                   <ul style="list-style-type: none"> <li>♣ Is there a clear point of view?</li> <li>♣ Quantity and quality of arguments that support the claim</li> <li>♣ Quantity and quality of counterarguments that support the counterclaim</li> <li>♣ Quality of refuting the counterarguments</li> <li>♣ Persuasiveness of the text</li> <li>♣ Presence of introduction and conclusion</li> <li>♣ Overall strong and weak elements</li> </ul> </li> <li>o Pairs write one joint text and provide feedback on their own text, by means of the evaluation rubric</li> </ul> </li> <li>• How to rewrite a text (implementing suggestions)?               <ul style="list-style-type: none"> <li>o Analysing suggestions for revision</li> <li>o Detecting weak parts in the text</li> <li>o Implementing the adjustments</li> <li>o Re-reading the revisions: is everything applied?</li> </ul> </li> </ul> <p>All explicit instruction on writing knowledge regarding argumentative texts and on writing strategies is summarised in an argumentation guide and a knowledge videoclip.</p>
3. Collaborative writing	<ul style="list-style-type: none"> <li>• In classroom practice:               <ul style="list-style-type: none"> <li>o value of collaborative writing is discussed</li> <li>o collaboration rules and goals are discussed and established</li> <li>o dialogic talk about responsibilities (each pair is responsible for delivering high-quality argumentative texts)</li> </ul> </li> <li>• Collaborative writing during all phases of the writing process               <ul style="list-style-type: none"> <li>o Planning: collaborative</li> <li>o Writing: collaborative</li> <li>o Revising: collaborative</li> <li>o Rewriting: collaborative</li> </ul> </li> </ul>
4. Writing opportunities	<p>Throughout the eight lessons, students receive ample writing opportunities. Students are offered challenging argumentative writing tasks (e.g., comparing weak and strong argumentative texts, classroom discussions on the progression of the texts).</p> <p>Teachers provide feedback on students' written texts.</p> <p>Teachers stimulate students to gradually diminish the use of the argumentation guide in view of internalizing the writing knowledge and strategies.</p>
Research condition EI+CW/IW	
1. Explicit instruction of writing knowledge regarding argumentative texts	Same as research condition EI+CW

Key components of the intervention study	Operationalisation of the key components
2. Explicit instruction on writing strategies	Same as research condition EI+CW, except for the revision phase: each individual student writes one text, pairs provide feedback on each other's text by means of the evaluation rubric
3. Alternating between individual and collaborative writing	<ul style="list-style-type: none"> <li>• In classroom practice:               <ul style="list-style-type: none"> <li>◦ value of collaborative writing is discussed</li> <li>◦ collaboration rules and goals are discussed and established</li> <li>◦ dialogic talk about responsibilities (each pair is responsible for delivering high-quality argumentative texts)</li> </ul> </li> <li>• EI+CW/IW: alternating between collaborative and individual writing               <ul style="list-style-type: none"> <li>◦ Planning: collaborative</li> <li>◦ Writing: individual</li> <li>◦ Revising: collaborative</li> <li>◦ Rewriting: individual</li> </ul> </li> </ul>
4. Writing opportunities	Same as in EI+CW research condition
Research condition MP+CW	
1. Explicit instruction of writing knowledge regarding argumentative texts	There was no explicit instruction on writing knowledge regarding argumentative texts
2. Explicit instruction on writing strategies	There was no explicit instruction on writing strategies
3. Collaborative writing	Same as research condition EI+CW
4. Writing opportunities	Throughout the eight lessons, students receive ample writing opportunities. Students are offered challenging argumentative writing tasks (e.g., classroom discussions on the progression of the texts). There were no opportunities to provide (peer)feedback in this condition.

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## Declarations

**Conflict of Interest** The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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