Improving University Argumentative Writing through Online Training

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Abstract: Writing an argumentation about a controversial issue from contradictory sources is a challenging task. It involves understanding, managing, and generating arguments and counterarguments from different sources to support a final position, conveyed in a formal structure. Despite its difficulty, argumentative writing is not often taught in higher education in Spain. Furthermore, online interventions regarding this type of task are scarce. For this reason, we designed and evaluated virtual training aimed at writing integrative and well-structured arguments in a distance learning university. Sixty-eight undergraduates participated in this pre-post with a control group design. The training included explicit instruction through video lectures and practice exercises with immediate feedback using open online resources (e.g., Moodle). The results show that after the instruction the participants' written products improved both in their structure, the number of arguments for the against-position, and the degree of integration of the two perspectives. However, those products that presented medium or maximum integration were still limited. These results illustrate how online instruction of argumentative writing can be implemented in higher education with positive results. However, students still need more support to expand their skills for generating integrative synthesis. Considering these results, we propose further improvements in the designed training.

Keywords: argumentation; academic writing; online training; self-efficacy

journal of WRITING RESEARCH

Luna, M., Villalón, R., Mateos, M., & Martín, E. (2020). Improving university argumentative writing through online training. *Journal of Writing Research, 12*(x), 233-262. https://doi.org/10.17239/jowr-2020.12.01.08

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1. Introduction

1.1 Teaching how to write an argumentation in a virtual environment

Learning to argue is essential for individuals to develop in their academic and personal life (Andrews, 2000). In democratic societies, being able to defend one's position and to consider others' perspectives is one of the core abilities for active citizenship as well as for political or institutional transformations (Andrews, 2010). Furthermore, in the knowledge society, it is fundamental that students can understand, elaborate, organize, and integrate information (List & Alexander, 2019). Nowadays, technological devices enable us to access millions of sources on the Internet that are sometimes complementary, but often contradictory.

In this context, students at all educational levels need to be able to argue taking into account the different positions relating to a topic. This ability can be promoted by teaching them to write syntheses after reading several texts (Nelson, 2008; van Ockenburg, van Weijen, & Rijlaarsdam, 2019) and can be more effective if the students are asked to write argumentative texts based on different sources. This kind of hybrid task is very complex and has a strong potential for learning (Mateos & Solé, 2009; Nelson, 2008; Segev-Miller, 2004; Solé, Miras, Castells, Espino, & Minguela, 2013). Consequently, writing an argumentation from sources is a common task in higher education (Andrews, 2010).

Despite the challenges posed by this task, little support is usually provided on the strategies needed to succeed in this kind of task (Solé, Teberosky, & Castello, 2012). In fact, few empirical studies have focused specifically on preparing higher education students to write argumentative texts about social sciences issues (Mateos et al., 2018; Nussbaum & Schraw, 2007), although there are some works related to history (De La Paz, Monte-Sano, Felton, Croninger, Jackson, & Piantedosi, 2017).

In the twenty-first century, the role of e-learning and the presence of distance learning universities are also remarkable. Thus, most higher education institutions have virtual campuses (CRUE, 2017) and the number of distance university students has greatly increased in recent years (i.e. Poulin & Straut, 2016). In this way, information and communication technologies are increasingly involved in teaching and learning activities.

However, online environments are different from face-to-face teaching, and it is pointless to use the same instructional design or materials: the instruction should be adapted (Deane & Guasch, 2015; Hewett, 2015). Therefore, we wanted to explore to what extent online instruction can be implemented to improve the number of arguments, the canonical structure, and the degree of integration of students' written argumentation. Besides, we wanted to ascertain the effect of two of the components that interventions usually have, i.e. explicit instruction and practice

with feedback (Kellogg, Whiyrford, & Quinlan, 2010; Mateos et al., 2018). Whereas online collaboration has received much attention by several researchers, (e.g. Noroozi, Kirschner, Biemans, & Mulder, 2018, or Nusbaum, 2012), these two elements that enable more autonomous learning have been less well addressed.

Furthermore, we were especially interested in developing training through the Moodle platform for two reasons. Firstly, Moodle is a free and open platform, which means that further developments can be carried out more easily. Secondly, this is the most used platform in the Spanish higher education system and is also widely used by other European universities (Fuentes-Pardo, Ramírez-Gómez, García-García, & Ayuga, 2012).

1.2 Theoretical framework

1.2.1. Writing an argumentation from sources

Effective argumentation involves generating arguments as well as understanding, evaluating, weighing, and combining arguments and counterarguments from different sources and perspectives, to support a final position (Nussbaum & Schraw, 2007). Research has highlighted that undergraduates need more explicit instructional support for self-regulation in order to overcome the difficulties they face when they have to write argumentative texts (Ferretti & Lewis, 2013). For example, the spontaneous use and identification of counterarguments are infrequent (Nussbaum & Kardash, 2005) in the construction of new and convincing arguments (Hyytinen, Löfström, & Lindblom-Ylänne, 2016). Furthermore, students have difficulties in integrating and providing counterarguments (Britt & Rouet, 2012; De La Paz & Felton, 2010; Hyytinen et al., 2016). Even undergraduates seem to experience problems with stating a clear position (Wolfe, Britt, & Butler, 2009); as well as considering different viewpoints, and especially the inclusion of arguments from other perspectives to overcome what is termed 'my-side bias' (Felton, Crowell, & Liu, 2015; Mateos et al., 2018; Nussbaum, 2008).

Moreover, explicit genre-based instruction has been highlighted as a useful aid to improve students' ability to write essays (Henry & Roseberry, 1999; Wingate, 2012). The awareness of the canonical structure of the argumentative texts may be important in the development of better argumentative text because college students often experience difficulties related to what essay writing is, and what its canonical structure should be. In fact, by including a proper introduction, an argumentative body and a conclusion can help writers to communicate the message of their argumentation better. This kind of structure may help students to better explain the different positions.

Furthermore, according to De La Paz et al. (2017), high school writers who had attended an intervention to enhance argumentative reading and writing produced

longer argumentative essays. In addition, in their recent research, McArthur, Jennings, and Phillippakos (2019) have shown that essay length is a variable and that it is strongly related to college students' argumentative writing quality when they write, in this case, without sources. The work of van Weijen, Rijlaarsdam & van den Bergh (2019) with argumentative writing from sources found that longer texts were generally rated with higher scores. For this reason, we decided to consider the number of words written by the students.

1.2.2. Technology-based writing instruction

During the last decade, several studies have addressed how to foster the argumentative skills of college students by employing computers and a virtual tool to accomplish their aims. Although the introduction of technologies in the educational context has increased in recent years, several studies indicate that these technologies by themselves do not produce any changes in the teaching and learning processes (European Commission, 2013). Therefore, although new technologies can modify the context in which educational interaction occurs, it is necessary to articulate measures so that they represent an authentic improvement in teaching and learning (Coll, Mauri & Onrubia, 2008). The possibility that new technologies can innovate and improve education arises from the compatibility of some of their characteristics with a constructivist approach (Nanjappa & Grant, 2003). Among these technologies, we are especially interested in those which enable a more personalized learning process and offer the possibility of hosting multimedia materials and the provision of immediate feedback. Additionally, technology-based writing instruction is not restricted to use in the physical environment of a classroom, therefore learners can access the intervention anywhere, and at any time, managing their own pace.

More specifically, a virtual guide can incorporate material and several tasks, such as questions and exercises on the writing of arguments, and the management of various sources in order to practice some of the concepts and procedures involved in the realization of an argumentative synthesis. This virtual guide could be perceived as a type of personalized material since it is possible to give immediate feedback to students, for example by providing them with a possible right answer as soon as the learner finishes. Besides, some resources even have the potential for adapting the next steps in the training depending on the previous answers of each student. Thus, a more personalized learning process is possible in large groups. Furthermore, these types of adaptations can help to alleviate the cognitive load of the tasks performed and increase the motivation towards them (Brusilovsky, Sosnovsky & Yudelson, 2009).

Another advantage of these kinds of technologies is that they allow the implementation of multimedia materials. This type of material combines two channels of information processing i.e. auditory and visual, and at the same time

reduces the burden of working memory by facilitating the processes of selection, organization, and integration of the information necessary to learn (Mayer, 2005). However, for multimedia material to achieve this goal it must be properly structured. For this, it has to combine the representation formats in such a way that the processing of accessory information is minimized, and the processing of essential information and the generation of knowledge is favoured, by allowing the learner to establish relationships using their prior knowledge (Clark & Mayer, 2011). For this reason, the virtual guide has the added value of including auditory material and graphic resources to favour the processes mentioned above. In contrast to what happens in a face-to-face teaching context, the materials can be re-visited as often as needed, allowing a more recursive process.

We already know that explicit instruction is a crucial component in writing instruction (Ockenburg, van Weijen, & Rijlaarsdam, 2019) and specifically for contradictory synthesis writing (Mateos et al., 2018). Some researchers (e.g. Butler & Britt, 2011; Wolfe et al., 2009), found that even a short tutorial that simply defined the terms and gave some explanations was effective in reducing some of the students' difficulties. More complex scaffolds could be in the form of video lectures, which have also shown to be useful in improving students writing (Lundstrom et al., 2015; Numrich & Kennedy, 2017). Besides, the use of videos and examples could be useful to raise motivation in virtual learning environments. (Raedts, Van Steendam, De Grez, Hendrickx, & Masui, 2017).

Guided practice with feedback has also been useful for improving writing and argumentation performance (Boscolo, Arfé, & Quarisa, 2007; Braasch et al., 2013; De La Paz & Felton, 2010; Nusbaum, 2008). In recent years, some automated scoring evaluation of essays with automated feedback has been developed (Allen, Jacovina, & McNamara, 2016; Kellogg, Whiyrford, & Quinlan, 2010; Palermo & Wilson, 2020). To the best of our knowledge, these kinds of tools are not available in Spanish, probably as a result of the specific grammar and syntax of this language. Therefore, it is important to be able to provide other types of feedback. As Wingate (2012) suggests, the feedback should show the relation between claiming one's position and the text structure. Therefore, students need to pay attention to their text structure, for instance, comparing it with an exemplary text.

When testing a technological tool, the users' satisfaction and perceived value of the scaffold is essential (Mateos et al., 2018). Therefore, we wanted to evaluate the students' perception of the usefulness of the intervention and their overall satisfaction. Furthermore, motivational variables such as writing self-efficacy are also important in the writing process (Pajares, 2003) and are usually taken into account when assessing the value of the training (i.e. Raedts et al., 2017).

As mentioned above writing is still scarcely taught at Spanish universities, and any instruction about how to write an argumentative synthesis is notably missing in these teaching practices (Castelló, & Mateos, 2015). This study belongs to a broader

project focused on developing interventions that can enhance synthesis writing among undergraduates. In particular, we have designed and implemented training that has used proven aids, such as explicit instruction and practice with immediate feedback to help university students to develop their argumentation skills. The explicit instruction used in this intervention focused especially on the acquisition of knowledge and the practice of some important skills to construct argumentative texts. Its designed principles, which will be explained in detail in the next section, included key features of explicit instruction: introduced some writing strategies and explained their importance; modeled the strategy; provided guided practice with feedback, and also provided independent practice (Perin, 2013). Nevertheless, this intervention did not include all the possible elements required to promote writing strategies. Although there are many elements on which interventions can focus (van Ockenburg, et al., 2019), this one was aimed at promoting the learning of some important requirements for argumentative writing and implementing effective writing strategies. Specifically, we wanted to know how these elements could be used in a relatively simple instructional design to help distance learning university students. In this study, we aimed to address, specifically both the students' argumentative writing adjustment to a genre structure as well as their integration skills as displayed by writing a synthesis from two contradictory texts.

1.3 The online training

We designed a virtual guide as an instructional package aimed at supporting undergraduates to write an argumentative synthesis from sources that presented conflicting information about a controversial issue. All the activities and resources that constituted the training are housed in the Moodle platform and are accompanied by a written explanation of the different steps necessary to complete the training.

This training was based on the design principles mentioned above. It is analytically described in Table 1 (see Appendix A) by defining also the teaching and learning activities following Rijlaarsdam, Janssen, Rietdijk & van Weijen (2018).

Table 1 shows that the training focused mainly on the linguistic aspects of argumentative texts i.e. structure, textual organizers and connectors, and on the identification and handling of arguments to write an integrative conclusion based on the sources. The technology that supported the training was the Moodle platform and several commonly used online tools such as Google forms, Google sites, Youtube, links to different websites and, Padlet. The Moodle quiz where the intervention was inserted allowed to include videos, links, and feedback that appeared automatically when the students sent their responses to the exercises.

1.4 The present study

The general aim of this work was to test the instructional assistance presented in Table 1 to improve argumentative writing, specifically in online teaching at the university level using a pre-post study with a control group design. We also wanted to gather information regarding the students' evaluation of the training provided. We therefore asked participants to assess to what extent they perceived their self-efficacy to carry out the different processes involved in the argumentation tasks had increased. Furthermore, we also asked them to evaluate their overall satisfaction with the training.

Our hypotheses were the following:

- Only the students in the training group would improve the quality of their argumentative writing structure.
- Only the students in the training group would produce an argumentative synthesis with an increased degree of integration, and an increase in both the number of arguments and the number of words.
- The students' perception of their self-efficacy about writing an argumentation would increase.
- The students would be satisfied with the instruction.

2. Method

2.1 Participants

Sixty-eight students who were attending their first or second year volunteered to participate (Age = 32.4 years-old –ST = 8.09; 57 female). The training was offered as part of an academic task of the subject "Psychology of Learning", within the Degrees of Education and Psychology of a distance university in Spain. Students were informed that the grade they would get would be based on their reflection on the learning task, not on the quality of their essays. All participants were native speakers of Spanish. They belonged to two class groups, coordinated by the same instructor and offered by two lectures, and were randomly assigned to the control (N = 35) or the training group (N = 33). The two groups were equivalent in average age (31.9 vs 32.8 years-old), year of studies (42% were enrolled in the first grade, 58% in the second grade) and perceived previous instruction- that is how much instruction they feel they had received during their academic career- (2.9/5 vs 3.3/5) All the ethical requirements of the University were fulfilled. The students were regular users of the Moodle platform since it was the primary online learning environment to carry out the learning activities in every subject of their degrees.

2.2 Procedure

In the context of the subject of "Psychology of Learning", the two lecturers coordinated to propose, within a set of activities, an assignment focused on learning to write better argumentative texts and to reflect on their learning process. Seventy-four percent of the students who were offered the activity began it. Ninety-five percent of the students agreed to perform the task being part of the study. The participants were randomly assigned to the experimental (training) or control group by the first author, but 13% of those who began the activity did not finally complete all the writing tasks. The 68 participants who completed all the steps were considered for this study. However, only 79% of the participants of the training group informed about their self-efficacy.

The data were collected during four weeks. The students had to follow different steps individually, in a precise order but at their own pace during a month. First, students were asked to answer a questionnaire to gather initial data (sociodemographic data, the degree they were enrolled in, their educational level, and their perception of previous argumentation instruction received) and to give their consent to participate in the study. Afterwards, they all read two texts which presented different positions about a controversial topic and wrote a conclusion about them, justifying it in a reasoned way. After uploading this first product, only the experimental group followed the virtual training environment at this point. Most of the participants employed between two and three hours to complete the instructional sequence (minimum time 45 minutes and maximum 373 minutes). Finally, all the students had to read two new texts about a different but equivalent issue and were asked to write and upload a new synthesis that integrated arguments from the two source texts. For the training group, the last step included completing the final questionnaire and uploading the link of the Padlet as a reflection about their learning process (the control group also had to carry out this reflection). Due to ethical reasons, the control group also received training, in this case after having uploaded the second synthesis. As the last step, the participants answer a final questionnaire to inform about their perceived change in self-efficacy and their satisfaction.

2.3 Materials

2.3.1. Source texts

The two pairs of source texts were about two educational topics in which controversy can be found: teacher evaluation (pre-test) and students' external assessment (post-test). Texts were equivalent in the number of words (between 630-815) and readability (Szigriszt-Pazos index between 44.8 and 56.8). Besides, each pair of opposing texts contained the same number of arguments for each perspective (nine for the pretest and five and six for the post-test text pairs).

2.3.2. Measures

Participants were asked to write an argumentative essay reporting their conclusion on the issues. Their written products were analysed considering the following variables: use of a canonical structure, number of words, number of arguments, and degree of integration:

Use of a canonical structure. For each argumentative students' products, the presence or absence of an explicit introduction, a body, and a conclusion paragraph were coded. Table 2 shows the description of the categories, "introduction", "body" and "conclusion". Since the participants' written products have to be based on the source texts, an excluding condition is the absence of arguments or topics directly related to the sources. The first author coded all the students' products and the second author coded 20% randomly selected texts. The inter-rater agreement was .87 (Kappa).

Table 2. Description of the categories 'Introduction', 'Body' and 'Conclusion' applied to the participants' written products

Category	To include a fragment as the category it must have...
Introduction	▪ At least one paragraph or sentence that raises the common topic of the source texts. ▪ At least one paragraph or sentence that establishes the writer's own opinion about the common topic of the two source texts. This paragraph or sentence must be followed by at least one more paragraph. ▪ At least one paragraph that gives a short description of each source text. This paragraph or sentence must be followed by at least one more paragraph.
Body	▪ At least one paragraph that includes an argument from any source text.
Conclusion	At least one paragraph or sentence that allows an answer to the question "so what?" by: ▪ synthesising arguments from the sources. ▪ presenting the writer's opinion about the topic. This paragraph or sentence will not be considered as a conclusion if it is the explanation of the writer's opinion is on a different, even though related, topic.

Number of words. The number of words of each students' text was counted.

Number of arguments of each source texts that a student included in his or her text. The essays were analysed to identify both the number of arguments from the text

in favour and against. We calculated the proportion of arguments as a function of the number of arguments presented in the source texts (for example, the number of arguments divided by nine possible arguments in the pre-test texts). Scores range from 0 to 1.

Degree of integration. The first author, trained by one of the authors of the coding system (Mateos et al., 2018), coded the argumentative texts written by the students. Six levels of integration were distinguished: 0) self-referral: when the author presents just a personal opinion and lack of references to the sources; (1) neutral: when the author does not define and argue his or her position; (2) in favour: when the argumentation does not take into account one of the positions; (3) rebuttal: when the argumentation takes into account the contrary position just to rebut it; (4) minimum integration: when the author includes several integrations along with the text (weighing or synthesizing both sides); (5) medium integration: when includes several integrations and a low integrative conclusion; (6) maximum integration: when includes several integrations and a global integrative conclusion. The second author coded 50% of the essays, which were randomly selected. The inter-rater agreement was .82 (Kappa), and the disagreements were solved through discussion.

Students in the experimental condition also gave their opinion on how satisfied they were with the training using 2 items on a 1-10 scale, and how much they felt the virtual training helped them to increase their self-efficacy, using 5 items on a 1-6 scale (see Appendix H). The internal consistency was assessed by Cronbach-Alpha (.95).

3. Results

We performed descriptive and mean contrast analysis. Descriptive statistics are reported in Table 3.

3.1 Training effects

To establish whether there were differences between the two conditions and the two times (Pre and Post), we carried out several analyses. We employed McNemar's test and Chi-Square to compare nominal variables (the three related to the structure of argumentation) and repeated measures ANOVA to compare interval variables (number of words, number of arguments, and degree of integration).

3.1.1 Structure of argumentation

In respect to the structure variables, that is to say, the presence of introduction, body, and conclusion, we performed two analyses. On the one hand, McNemar's test reveals no significant differences between the three structure variables com-

Table 3: Descriptive statistics of the variables for each group in the Pre- and Post-tests

	Conditions							
	Control group (n = 33)				Training group (n = 35)			
	PRE		POST		PRE		POST	
	M	SD	M	SD	M	SD	M	SD
Presence of introduction	.69	.47	.54	.51	.48	.50	.79	.41
Presence of body	.94	.24	.91	.28	.85	.36	1	0
Presence of conclusion	.43	.50	.40	.50	.42	.50	.91	.29
Proportion of arguments in favour selected	.30	.18	.31	.22	.31	.20	.38	.19
Proportion of arguments against selected	.29	.24	.26	.18	.25	.21	.47	.17
Number of words	467.6	226.3	408.9	214.5	627.0	335.9	476.7	170.9
Degree of syntheses' integration	1.9	1.19	1.83	0.95	2.09	1.2	3.06	1.60

paring pre-test and post-tests syntheses for the control condition. However, it indicates significant differences in the experimental group, so a higher presence of both introductions ($p = .031$) and conclusions ($p<.001$) was found after the training.

On the other hand, the Chi-Square test indicates no significant differences between the training group and the control group for those two structure variables in the pre-test syntheses, but a higher score for the presence of introduction (χ^2 (1) = 4.556, $p = .037$) and the conclusion (χ^2 (1) = 19.276, $p < .001$) variables in the experimental group in the post-test syntheses.

3.1.2 Number of arguments

Concerning the number of arguments of the in-favour position, no significant differences were found, so both groups included a similar number of arguments of the in-favour text in the pre-test and the post-test.

With respect to the number of against-position arguments, a main effect of time was found (F(1, 65)=11.44, MSe=.05, p=.001, η^2_p=.15. but this effect is qualified

because the analysis of the results also reveals an interaction between time and group factors (F(1, 65)=17.60, MSe=.51, p<.001, η^2_p=.21). Thus, the training group increased their number of against-position arguments in the post-test syntheses, while in the control group the opposite happened.

3.1.3 Degree of integration

Concerning the degree of integration, no main effect was found for condition factor, but a significant effect was found for the time factor (F(1, 66)=11.60, MSe=31976.05, p=.001, η^2_p=.15); The written argumentative synthesis scores were greater on the post-test syntheses than on the pre-test ones. However, this result should be qualified because the interaction between time (pre vs post) and group (control vs training) factors was significant (F(1. 66)=5.94, MSe=1.42, p=.017, η^2_p=.08); the training group increased their scores in the synthesis post-test more than the control group.

3.1.4 Number of words

With respect to the number of words, the training group employed more words than the control group in both pre and post-test, so they were not equivalent (results found a main effect of condition F(1, 66)=5.04, MSe=8698.47, p=.028, η^2_p=.07) and of time (F(1, 66)=11.60, MSe=31976.05, p=.001, η^2_p=.15).

3.2 Students' self-efficacy and evaluation of the intervention

We carried out a descriptive analysis to address how participants in the training group perceived their self-efficacy and their satisfaction with the intervention. Only part of the students reported these data.

With respect to students' self-efficacy, we asked them to what extent do they think their competence on different abilities of argumentative writing has changed after the intervention. As can be seen in Table 4, scores were always above 4, on a 1-6 scale.

Table 4: Means scores with standard deviations of the training group's perception of self-efficacy increment for different abilities after the training

Variable	N	M	SD
Providing supporting arguments	26	4.35	1.23
Providing contra arguments	26	4.46	1.14
Rebate others' arguments	26	4.27	1.07
Weigh or synthesis opposite arguments	26	4.42	0.94
Reaching a solution to the controversy	26	4.62	1.09

Note: Scores range: 1-6

Regarding students' evaluation of the task, participants in the training condition reported, on a 1-10 scale, to what extent they were satisfied with the practice and with the training. They perceived the chance to practice with two syntheses as very useful (M = 5.45, ST = 8.33). Additionally, they were overall satisfied with the training (n = 18; M = 7.89, ST = 1.45).

4. Discussion

4.1 Conclusions and educational implications

This study shows an approach to implementing training designed to enhance argumentative writing in a fully online teaching environment developed in a higher education context. Overall, our data support most of our hypotheses.

Regarding the first hypothesis, this has been supported. Only the students in the training group wrote better-structured texts, which more frequently included a proper introduction and conclusion. After the training, our participants were capable both of writing better-structured texts and presenting an integrative position more clearly. The training may also have been useful in clarifying the relationship between structure and positioning, which it is an element highlighted by Wingate (2012) as an important component of instruction in written argumentation.

With respect to the second hypothesis, this has been partially supported. Thus, undergraduates in the training group included a higher proportion of arguments for the against-position. This illustrates that they were more likely to include arguments from the opposing perspective. However, regarding the number of words the results indicated that the experimental and the control group were not equivalent groups on the length of their argumentations, which precluded an analysis of the role of word length in the training programme. Since only the work of van Weijen et. al. (2019) addressed the relationship between the number of words and the quality of written argumentation from sources, further studies should take this variable into account.

Regarding the degree of integration, the participants in the experimental group achieved a higher level of integration in their final written products than in their initial ones. In general terms, the kind of training provided in this study seems appropriate at least to some extent, to overcome the common difficulties with integrating (Britt & Rouet, 2012; De La Paz & Felton, 2010; Hyytinen et al., 2016) and stating the writer's position (Wolf, Britt, & Butler, 2009).

However, even if the experimental group had improved their level of integration, the products that presented medium and maximum scores in this variable were still scarce. Despite the fact that the students took into account both positions from the sources to a greater extent, in general terms they still struggled

to reach high integrative conclusions. In the same way that Hyytinen et al. (2016) noted, we can conclude that the participants should still improve the generation of new integrative arguments and need to receive more effective training on these abilities. Although we found positive effects of our instructional design, further research needs to continue to explore which elements of explicit instruction on writing strategies help the most to improve the self-regulation of students (Barzilai, Zohar, & Mor-Hagani, 2018) and also how to implement them in distance learning contexts (Deane & Guasch, 2015). The main results of this study concur with research that indicates that a scaffold aimed at clarifying terms and concepts, can be effective in improving students' writing (Butler & Britt, 2011; Wolfe et al., 2009).

Finally, regarding the last two hypotheses, the participants in the training group reported that they were satisfied with the instruction and perceived that their self-efficacy had increased. These are interesting results because Pajares (2003) showed that the students' confidence in their writing abilities was related to their writing achievements. Furthermore, most of them finished the virtual guide and found it useful and recognized its value. This is always very important, but even more so in a distance learning context, where delivering a motivational, but not excessive workload resources is essential (Mayer, 2005; Milligan et al., 2013). Creating 'user-friendly' instructional support is an important factor in the success of virtual learning environments, where students may feel more alone than in the traditional face to face teaching (Roddy, 2017).

Through this study, we have analysed a learning environment that uses widespread tools at distance university teaching or higher education institutions with virtual campuses. The design of the training aims to promote the learner's activity to achieve meaningful learning and some basic skills to write argumentations. The instruction uses a Moodle quiz as a formative lesson with practice and immediate feedback. The lesson includes Google tools such as Youtube, Google sites and forms, Padlet, Kazam, and links to different web pages. It is, therefore, a set of aids that are relatively easy to implement, and which can be used to provide large groups of students with learning activities to improve academic writing skills.

In summary, this study shows that training designed following instructional principles can be implemented with the most commonly used technology and supported students' writing. Specifically, it helped undergraduates to write better-structured texts, to take more into account arguments from the opposing perspective, and to achieve a higher level of integration. Besides, the assistance designed provided an appreciated training environment to help the students to progress towards becoming better writers of argumentative texts based on contradictory sources and thus, become more capable citizens in the current

society. Providing research conclusions about online interventions is undoubtedly of practical interest to help to improve the quality of higher education.

4.2 Limitations and future developments

This training environment has given promising results, however, there are areas in which it should be improved. In the future, we propose to include more instruction on the metacognitive processes that can foster the integration in the writing products, while making the student aware of textual structure (in line with Benetos & Bétrancourt, 2020). Taking into consideration that it is possible to improve some writing skills in this kind of learning environment, the following steps aim to introduce more complex explicit instruction about writing strategies. The results of this study have highlighted some of the difficulties which need to be addressed in future interventions.

Furthermore, some technical improvements can be developed. Moodle can register information about how the learning environment was used by the students. It tracks some of the students' activity, e.g. the number of times a student uses the guide. However, this information could be captured more precisely, recording how much time the users spend using a specific resource. Furthermore, these data are difficult to be gathered but they might allow the researcher to achieve a greater understanding of the learning processes. It might be that spending more time on one resource would be useful for a certain student profile and not for another one. This could help to overcome another limitation of this study: the intervention presented does not yet have personalized paths for the different types of student responses. However, as a result of the knowledge provided by this study, it is possible to build alternative routes that can focus on the different types of difficulties detected by offering, for example, alternative explanations and more practice on some of the elements. In addition, this road to personalization might include feedback that the teacher can include as a comment on the responses recorded on the platform or that can be provided thanks to a combined use with Inputlog's new features for process-oriented feedback (Vandermeulen, Leijten & Van Waes, 2020). If in the future Moodle can provide easily more concrete details, this information could be very helpful in adjusting the virtual tool, especially if it is implemented in a study with an iterative approach. Both elements could no doubt be beneficial to make successive improvements to the design of the instructional package.

Other limitations are also acknowledged. First, we asked the participants to what extent they thought their competence on different abilities of argumentative writing had changed after the intervention, but it could be interesting as well to have a measurement of self-efficacy perceptions from pre-test to post-test. Second, further research should incorporate larger samples, and participants not only from Education or Psychology, giving the relevance of teaching argumentation in specific

disciplines. In addition, it could be also interesting to have explored the adaptation required in different settings, such as blended learning teaching. Finally, qualitative studies could shed light on how students perceive the tool and how a more reflexive and optimal use can be promoted.

Despite these limitations, this study raises promising results about how instructional designs on argumentative writing could be implemented in a free and open-source online environment.

Acknowledgments

The research reported in this article was funded by Ministerio de Economía y Competitividad, Reference EDU2013-46606-C2-1-R.

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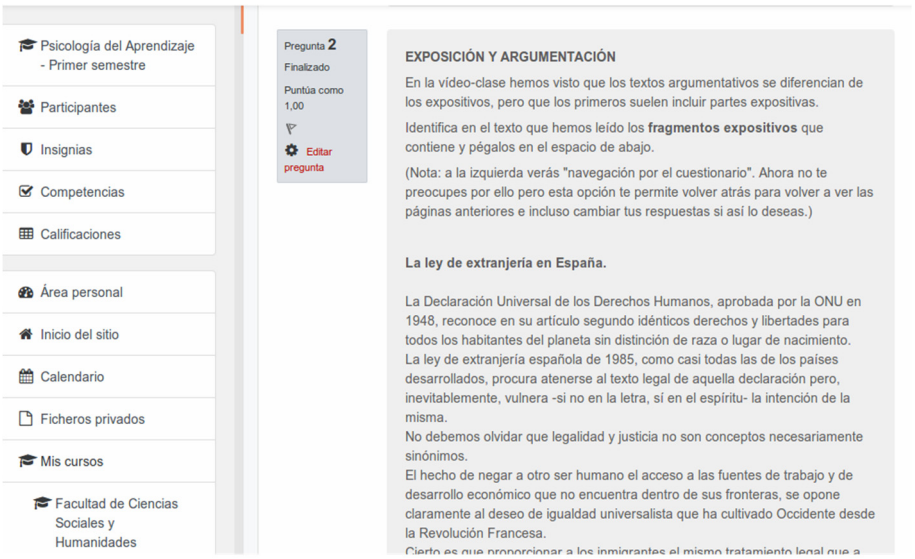
Appendix B: Video Lesson Included in the First Question of the Moodle Quiz

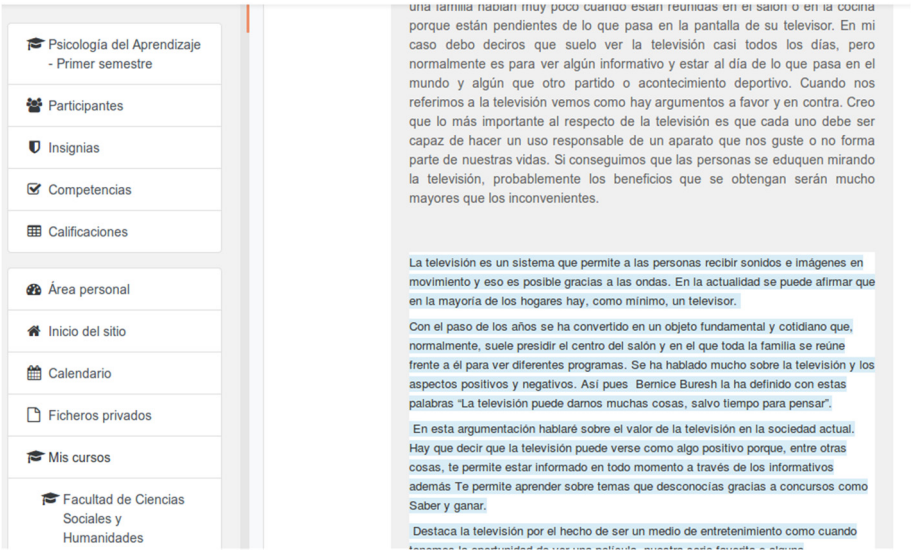
Appendix C: Exercise 1

Approach: Identify and Copy Expository Fragments of a Text in the Answer Space



Appendix D: A Student's answer to Exercise 2

Introduce Title, Paragraph Divisions, Textual Organizers and Connectors



Appendix E: Explanation of the Feedback on Exercise 2

Appendix F: Approach and a Student's Answer to Exercise 3

Write a Text which Includes Arguments and False Arguments

Appendix G: Video Tutorial to Create a Padlet to Organize the Reflection about Self-learning Process

Appendix H: Items to Assess the Students' Perceived Change in their Self-efficacy

1- Assess the extent to which you think your competence has changed, when you argue in writing, to make arguments in favor of the position you defend.

2- Assess the extent to which you believe that your competence has changed, when you argue in writing, to raise counterarguments (reasons that could be used by those who disagree with you).

3- Assess the extent to which you believe your competence has changed, when you argue in writing, to refute counter-arguments (show that the counter-arguments are false or incorrect).

4- Assess the extent to which you think your competence has changed, when you argue in writing, to weigh arguments and counter-arguments (to decide which position is stronger).

5- Assess the extent to which you think your competence has changed, when you argue in writing, to propose solutions that take into account both arguments and counter-arguments.

Appendix A: Table 1 - Training description

Design principle	Phase	Learning activity		Instruction/task, that leads to learning activity	
		Description	Explanation	Description	Explanation
Representation of the task and attribution of meaning	Problem centred	Representing the aim of the instruction via reading a short text	This learning activity is effective in motivating the students and focuses their attention on the goal.	The student begins a Moodle quiz. The first question briefly introduces the whole instructional setting, indicating that the objective of the training is to get to know better the argumentative texts.	This element in the instruction leads to an understanding and involvement in the task by reading a written paragraph.
- Meaningful verbal learning - Learning by the observation of a model	- Activation of existing knowledge - Demonstra-tion of new knowledge	Explorative thinking fostered by a lesson with a modelling part	This learning activity aims to foster meaningful learning about reading and writing argumentative texts.	Continuing the first content of the Moodle quiz, a 15 minutes master class with PowerPoint support is presented. It was recorded in a TV studio. The students can watch this on a Youtube video embed within or through a link. We recommend that the students take notes or open it in a different window, so that they can watch it again during the training. The training video lesson includes explanations and a modelling by the teacher. Content of the video in order of presentation: - definition of argumentation. - objectives of the argumentative texts vs expository texts	This element in the instruction is intends to activate prior knowledge and to offer an explanation of the main characteristics of the argumentative texts. The observation of the model leads to identify the elements of the texts structure and the arguments included in the text. (see Appendix B)

	- combination of the expository and argumentative parts in written argumentation - linguistic characteristics: opinion verbs, textual organizers, discourse markers and connectors. - text structure: introduction (approach to the topic), argumentative body (thesis and reasons), conclusion (synthesis of the thesis and main arguments), modelling of the structure analysis of an argumentative text about immigration law (244 words). The teacher shows students how to identify which elements of the text refer to the introduction, the thesis, premise and argument 1, counterargument, rebuttal of counter argument 2, premise and conclusion. - types of arguments - types of argumentation: positive: present arguments that support our position; negative or refutation: presentation of arguments that refute the arguments of the opposite position; mixed: integrates arguments and counterarguments of the two positions to reach a conclusion (the teacher highlights that this is the one that is of particular interest). - most common mistakes in argumentation. - how to write a text? (writing instructions): read the source texts, identify the arguments, weigh up the reasons and rank them. It is important to present both arguments in favour and those that support the opposite thesis; adopt a position or establish a conclusion that takes into account what

				has been said in the source texts. It is possible to add arguments but not mere opinions.	
- Learner's activity - Self-regulated learning	Applying new knowledge	Analysing the intentions of different fragments in a given text.	Exercise 1. This learning activity is aims to foster the learners' practice of their new knowledge. Specifically, it is aimed at promoting a better analysis of argumentative texts. The online environment makes it possible to include immediate feedback, which may improve the processes of self-regulated learning.	The next question presents the same text about immigration law. The students are asked to do an exercise by identifying the expository fragments and copy-paste them in the space for the answer. Written feedback is provided immediately after sending the answer: the clear argumentative fragments are shown. An explanation is offered regarding other possible dubious fragments.	This element in the instruction leads to the autonomous practice of identifying expository and argumentative fragments in a text. After the practice, automated feedback is provided. (see Appendix C)
- Learner's activity - Self-regulated learning	Applying new knowledge	Structuring the text by adding missing key elements.	Exercise 2. This learning activity is aims to foster the learners' practice of their new knowledge. Specifically, it is intended to promote learning of important elements	The next question presents a new text of 385 words, about the value of television for society. It explains that the text lacks a title, paragraph divisions, textual organizers and connectors. The students are asked to do an exercise by copying it in the space for the answer and to improve it by introducing the missing elements. The modifications have to be appropriate to connect the different ideas within the text and to organize the discourse.	This element in the instruction leads to the autonomous practice of better organizing an argumentative text. After the practice, automated feedback is provided. (Appendices D and E)

			for text organization. The online environment makes it possible to include immediate feedback, which may improve the processes of self-regulated learning.	Written feedback is provided immediately after sending the answer: "the previous text comes from this web page. Click and check to see how the original text was written. (http://www.ejemplosdetextos.com/ejemplo-de-texto-argumentativo-sobre-la-television/#more-49) Your solution may have been correct, even if it does not fully match this version. The key point is to practice the use of the linguistic elements of the argumentative texts".	
- Learner's activity - Meaningful verbal learning	Applying new knowledge	Practicing the generation of arguments and writing a text about a given topic.	Exercise 3. This learning activity aims to foster the learners' practice of their new knowledge. Specifically, it is aimed at promoting the writing of an argumentative text. The student is encouraged to learn more about the types of arguments immediately after the practice, which may enhance the connection to their prior knowledge.	The next question briefly explains that it is crucial to identify and create different types of arguments. It then asks the student to build a short text of about 200 words or 15 lines, providing an argument about how the Internet has improved people's lives, including underlining different types of arguments and at least one false argument that they have invented. A link with further information about the different types of arguments is provided in case they want to go explore this topic further. (http://elarlequindehielo.obolog.es/selectividad-lengua-castellana-tipos-argumentos-138776)	This element in the instruction leads to the autonomous practice enabling the students to be able to build proper arguments. After the practice, students can expand their knowledge about different types of arguments. (Appendix F)

Learner's awareness	Integrating new knowledge	Analysing the self-learning process.	This learning activity aims to foster learner's awareness about their learning. Specifically, it encourages a reflection upon the new knowledge acquired and what may yet still to be known.	The next question provides a 11-minutes tutorial video. It was aimed at teaching students how to create diagrams with Padlet and, specifically, one that makes explicit their process of knowledge acquisition. The students are asked to create a Padlet showing their previous knowledge about argumentative texts, their new knowledge and their doubts. The video was recorded using Kazam Screencaster, uploaded onto Youtube and embedded.	This element leads to an analysis of the self-learning process by constructing a diagram. For it, it provides instruction on a proper technical use of a graphical tool. (Appendix G)