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Supporting Integration of Multiple Source Perspectives Through Dialogic Argumentation

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Abstract

We report a study examining, for the first time, the effectiveness of engagement in dialogic argumentation in relation to its ability to promote integration of multiple source perspectives in an argumentive writing task after reading controversial multiple texts. Sixty-four primary school students engaged in a dialog-based intervention aiming to support them to learn to argue. Participants' argument skills have been improved and transferred to a writing task completed after reading novel multiple texts on new, non-intervention, topics. In particular, the experimental group participants showed gains in their ability to integrate multiple source perspectives in an argumentive writing task after reading controversial multiple texts, compared with a control group which engaged in business-as-usual school curriculum. Microgenetic data revealed a progressive development of experimental participants' integration skill throughout their engagement in the argumentive discourse activity. The findings have important educational implications. They show that learning to argue by engaging in dialogic argumentation is a promising pathway for supporting the ability to integrate multiple source perspectives after reading controversial multiple texts.

Keywords: argumentation; multiple texts; integration; argument skill; multiple source perspectives

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1. Introduction

Individuals are often called to take positions and make decisions on issues of individual interest, such as vaccination, or issues of societal interest, such as immigration and climate change, for which they seek consultation from external sources to form a belief. Depending on others, especially experts, in forming beliefs and making decisions is almost inevitable in our era of complexity and hyperspecialization (Duncan, Chinn, & Barzilai, 2018; Kienhues, Jucks, & Bromme, 2020; Rabb et al., 2019). The replacement of a single textbook, or newspaper that used to serve as the single main source for learning and being up-to-date by a plethora of sources on the internet which provide, in many cases, different perspectives about an issue makes this task more challenging. Therefore, the ability to handle effectively multiple sources appears imperative in our digital age where individuals have access to multiple sources at the click of a button. Taking into consideration different perspectives and the available data is an important skill for making the right decision at a particular time, and at the societal level, for avoiding extremism and supporting democracy.

Yet, individuals struggle to integrate information from alternative perspectives, constructing instead one-sided representations (Richter & Maier 2017; Tarchi & Mason, 2020). Recent results provided by the Organisation for Economic Co-operation and Development (OECD)'s Programme for International Student Assessment (PISA), measuring 15-year-olds' ability for reading, mathematics and science, revealed that the majority of students (73.7%) can identify the main idea of a single text – reaching level 2 of reading proficiency – but only a mere 1.2% can integrate multiple perspectives from multiple texts, that is expected by skilled readers, reaching the most advanced level (Level 6) of reading proficiency (OECD, 2023). An emerging line of interdisciplinary research attempts to understand how individuals make sense of information from varying sources (Van Meteris et al., 2020). For instance, a fundamental skill when reading multiple texts is to understand the authors' way of thinking and representing a particular issue, namely identification of source perspective (Barzilai & Weinstock, 2020). Following Barzilai and Weinstock, we define *source perspective,* as "the perspective of the authors or organizations who create and communicate information using texts" (p. 5) and *source perspective comprehension* as "readers' understanding of authors' particular ways of thinking and knowing and how these inform authors' interpretation and representation of the issue at hand" (p. 3). Despite the importance of this skill for understanding multiple texts and using effectively the information represented in them, as well as individuals' limitations in their ability to identify source perspective, our understanding of how to develop it remains limited (Wiley et al., 2018).

This study focuses on people's ability to integrate source perspectives from multiple texts into reasoning, with a particular emphasis on how to develop this ability. We examine whether engagement in dialogic argumentive reasoning supports integration of multiple source perspectives in argumentive reasoning. Although there is empirical evidence showing that engagement in dialogic argumentation can support the development of two-sided reasoning, that is, taking into consideration opposing views on a topic (Felton & Herko, 2004; Kuhn & Crowell, 2011), to the best of our knowledge, there is no evidence showing whether engagement in dialogic reasoning can support integration of *source* perspectives. The latter refers to the identification of text authors' particular perspective on an issue when reading a text and incorporation of different authors' perspectives in argumentive writing, after reading multiple texts on a particular topic. In this work, we examine whether gains acquired after engagement in dialogic argumentation transfer to individuals' ability to integrate different source perspectives in a writing task after reading multiple texts on a particular issue.

2. Identifying and Integrating Multiple Source Perspectives in Multiple Text Comprehension

The ability to identify different views presented in different texts – that is, source perspective – is a fundamental ability for multiple text comprehension. In fact, identification and integration of source perspective constitutes an integral component of theoretical models on multiple-text comprehension. For example, integration of information is one of the five essential steps involved in comprehension of multiple texts in the MD-TRACE (Multiple-Document Task-based Relevance Assessment and Content Extraction) model (Britt & Rouet, 2012). The other steps involve creating a task model with information about the goals of reading and how to achieve this, accessing the need for further information, engaging with the completion of the task product, and evaluating the degree of completion of the task. Similarly, integration of information is part of the execution stage of the 3-stage model of the Integrated Framework of Multiple Texts (List & Alexander, 2019). After the preparation stage, when the reader conceptualizes the objectives of the task, and before the production stage where the reader produces an external product, such as a written essay, is the execution stage. In the latter the reader engages in several cognitive and metacognitive strategies while processing the documents, such as identification, representation, and synthesis.

To form multiple source perspectives, one needs to have the ability to develop a metarepresentation of each text, where the representation of a particular phenomenon is seen as the author's representation involving the particular way that the author interprets and represents the phenomenon (Barzilai & Weinstock, 2020), rather than an objective reflection of how things are in the external world. The ability to infer and consider the views of an author of an academic text is connected with one's ability to engage with the text as well as with academic engagement and performance(Kim et al., 2018).

Yet, empirical studies show that individuals of different ages struggle with identification and integration of source perspective. Almost half of the individuals examined in different studies and of different age groups were not able to identify contrastive views when reading different sources on a particular topic (Barzilai, Tzadok, & Eshet-Alkalai, 2015; Coiro, Coscarelli, Maykel, & Forzani, 2015; Hobbs & Frost, 2003) or when writing integrative reports (List et al., 2019; Mateos & Solé, 2009). After reading multiple-texts on a particular issue, and if not explicitly prompted to take multiple texts into consideration, individuals tend to rely on a single text when engaged in a writing task (Monte-Sano & De La Paz, 2012; Iordanou et al., 2020; Stahl et al., 1996). Even when prompting does take place, elementary school students do not seem to be able to identify position differences between the texts (Paul, Stadtler, & Bromme, 2019).

Intervention studies aiming to promote individuals' ability to identify and integrate multiple source perspectives have shown mixed results (De La Paz et al., 2017; Monte-Sano, 2011). For example, Barzilai and Ka'adan (2017) reported that although scaffolding integration improved high-school students' integration performance (effect size: $\eta_p^2 = .08$), they still found it difficult to construct fully justified dual-position arguments and address all differences between accounts. Review studies on multiple documents acknowledge the need for further research examining how (i.e., with which activities) to support effective engagement with multiple documents (Wiley et al., 2018). This work examines whether engagement in dialogic activity is a promising way for supporting identification and integration of multiple source perspectives after reading multiple texts.

3. Dialogic Argumentation and Multiple Perspectives

3.1 Dialogic Argumentation and Integration of Multiple Source Perspectives from Multiple Texts: Theoretical Underpinnings

The theoretical rationale underpinning the role of dialogic argumentation in promoting students' ability to identify different perspectives when reading multiple texts and integrate them into reasoning, derives from the proposed connection between construction and evaluation of arguments, which constitute facets of argumentive reasoning (Iordanou, Kendeou, & Beker, 2016) and the conception that reasoning skills emerge and are developed first on the social plane before become internalized, which, in turn, derives from the sociocognitive and sociocultural theories. Starting from the latter, both Piaget (1928) and Vygotsky (1978) conceived social interaction as the primary means for supporting the development of individual reasoning. Engagement in dialogic argumentation in the social sphere supports the development of important meta-level insights of the norms of argumentation, but also of the nature of knowledge (Iordanou, 2022; Kuhn et al., 2013; Rapanta & Felton, 2022; Chinn et al., 2011). One important epistemic understanding that develops through dialogic argumentation is that there is no single self-evident truth and that multiple interpretations may exist of the same phenomenon as the human mind plays an active role in ascribing meaning to the world (Iordanou, 2016a; Kuhn et al., 2008). This epistemic understanding of other people's thinking as represented in multiple accounts is fundamental for integration of multiple source perspectives from multiple texts (Kuhn, 2020).

Based on the theoretical proposal that argument construction, which is evident during dialogic argumentation, and argument evaluation, which is evident during text comprehension, are two different facets of the same argumentive reasoning and are both supported by the same core skills (Iordanou, Kendeou, & Beker, 2016), we would expect that gains developed during dialogic argumentation at the social plane would become internalized and manifest at the individual level in other instances which require argumentive reasoning, such as when reading arguments in the context of one or multiple texts.

3.2 Dialogic Argumentation Interventions

The ability to take into consideration multiple, even contradicting views, when one reasons is considered fundamental for skilled reasoning in the reasoning literature (Walton, 1999). According to Graff (2003), the inclusion of multiple perspectives is what actually gives status and value to an argument itself. A comprehensive line of research on argumentation has offered empirical evidence showing that reasoning skills are amenable to improvement when received direct attention. In particular, engagement in dialogic argumentation appears to be a fruitful way to promote two-sided reasoning (see Iordanou & Rapanta, 2021, for a review of studies) and reduce my-side bias (Felton et al., 2015). For example, students who had extensive practice in dialogic argumentation showed gains in using counterarguments and acknowledging opposing views which transferred from the social to the individual plane when writing an essay on a novel topic (Iordanou & Kuhn, 2020; Kuhn & Crowell, 2011; Shi et al., 2019). Notably, the strategic gains of engagement in dialogic argumentation transferred to new topics within a particular knowledge domain – Science (Iordanou & Constantinou, 2015; Iordanou & Kuhn, 2020) and Social (Kuhn et al., 2008) – as well as across knowledge domains (Iordanou, 2010). This shows that some form of meta-level understanding develops which is then transferable to a context different from the one that has originally been developed. Studies using the microgenetic method, aiming to get some insight into the mechanism behind development of argument skills, found that a meta-strategic understanding of the norms of argumentation is developing and supports development of argument skill (Iordanou & Constantinou, 2015; Kuhn et al., 2008; Shi, 2020). Besides meta-strategic gains, epistemological gains on the nature of knowledge and process of knowing have also been observed to be the result of extensive engagement in dialogic argumentation (Iordanou, 2010, 2016b, 2022; Shi, 2020; Zavala & Kuhn, 2017). Yet, the transfer of gains in reasoning after engagement in an argument-based intervention on reading multiple texts and integrating multiple perspectives represented in different texts has not been explored in the argumentation literature.

The Present Study

In the present work, we extend the previous line of research by examining whether engagement in systematic dialogic argumentation can support one's ability to integrate multiple source perspectives in argumentive reasoning, after reading contrasting multiple texts on a particular topic. Our research question was the following: Does engagement in dialogic argumentation support the ability to integrate multiple source perspectives from multiple texts? Based on the findings of previous research showing that a meta-level understanding of the norms of argumentation and the epistemic nature of knowledge ― acknowledging the role of human interpretation and therefore of multiple perspectives on an issue (Iordanou, 2022) ― develops when engaged in dialogic argumentation, we hypothesize that engagement in dialogic argumentation can be a fruitful means for promoting identification of multiple perspectives in multiple text comprehension and integration of those perspectives when writing an argumentive essay.

We examine whether engaging in dialogic argumentation with peers who hold opposing views on a topic, can help individuals to develop the ability to identify opposing views when reading multiple texts on an issue, and integrate those views in a written argumentive task. Based on evidence from previous research showing that engagement in dialogic argumentation ― in person or through the computer ― with peers holding opposing views, supports the development of two-sided thinking (Kuhn & Udell, 2003; Kuhn et al., 2008), we hypothesize that individuals will transfer this ability from writing a two-sided report on the intervention topic to writing a two-sided report on a novel, non-intervention, topic, after reading different texts depicting different perspectives on an issue. Previous research has also shown that asking individuals to write an argument is more effective for integrating views from multiple sources than asking them to write a summary (Bigot & Rouet, 2007; Maier & Richter, 2016; Stadtler et al., 2014), providing further evidence of the potential of engagement in argumentive activities in promoting integration of multiple source perspectives from multiple texts.

Previous research on reading comprehension that has examined the effectiveness of dialog-based pedagogical practices for promoting text comprehension focused on the effects of text-based discussion (see Murphy et al. 2009 for a review) on single text comprehension. The novelty of the present study lies in both the medium used and the dependent variable examined. Firstly, we investigated the power of engagement in the activity of dialogic discussion on a controversial topic, independently of a particular text. Secondly, we examined the effect of engagement in dialogic activity not on a single-text comprehension, but on multiple-texts comprehension. To the best of our knowledge, this is the first time that dialogic argumentation is examined as a tool for promoting multiple text comprehension, as evident in individuals' ability to incorporate the multiple perspectives presented in multiple texts in writing an essay.

In the present study we asked our participants to engage in dialogic argumentation for 14 sessions before we asked them to write an argumentive essay after reading two different texts on a novel topic, each of which presented a different view on the topic. Participants conducted the dialogs electronically via instant-messaging software using tablets. This method, which has extensively been used in previous work, offers the advantage of providing an immediately available record of the discourse that participants can use to reflect on. We used authentic sources in line with recent recommendations to use authentic learning environments and authentic information sources (Chinn, Barzilai & Duncan, 2021). We are interested in examining whether engagement in dialogic argumentative-based intervention can support the development of skills needed in real-life, that is identification of authors' perspectives when reading authentic texts, found on the web. Another group of students, which was assessed at the same time points as experimental condition students, but engaged in business-as-usual school activities, served as a control condition. Participants' integration of multiple source perspectives was assessed at initial and final assessment using an open-ended question instrument (Barzilai & Ka'adan, 2017; Bråten et al., 2014). Participants' integration performance was assessed in two novel topics, one in the same domain as the intervention topic — Social Science domain — and another one in a different domain from the intervention topic – Physical Science — to examine far

transfer. Furthermore, integration of multiple source perspectives was examined, using the microgenetic method, throughout the intervention — coding all the experimental condition's dialogs — to identify any possible pattern of development that would enable us to get some insights into the mechanism that supported the development of integration of multiple source perspectives.

4. Methodology

4.1 Participants

The participants of this study were 64 sixth graders (11- to 12-year-olds) from four classes. They were recruited from three public primary schools in Cyprus. The study was conducted in accordance with the Declaration of Helsinki and with ethics approval from the Cyprus National Bioethics Committee and the Cyprus Ministry of Education, Sport and Youth Written parental consent was obtained for each child. In addition, all children were informed orally about the study.

Two classes, from two different schools, served as the experimental condition (34 students; 16 female), and two classes from a third school served as the control condition (30 students; 15 female). The size of the recruited sample exceeded the required sample size of 40, as determined by an a-priori power analysis for repeated measures ANOVA, within-between interaction, (GPower, Version 3.1.9.7). Power was set to 0.80, α-error to 0.05, and the assumed effect size to $\eta^2_p = .05$, as recent studies documented medium effects of integration performance – interaction between time and group (Barzilai & Ka'adan, 2016). The participants were from middle-class families and with primarily an average academic achievement, typical of those schools.

4.2 Measures

During the initial and final assessment phase, the experimental and control condition participants' argument skill, integration of multiple source perspectives and prior knowledge were assessed at about the same time in the middle of the school year. The initial and final assessment phase was identical for the experimental and control condition (i.e. instructions, materials, time). Participants' argument skills and multiple source perspectives were assessed on non-intervention topics, aiming to assess transfer of intervention gains. The final assessment took place two days after the completion of the intervention. This phase took the same form as the initial assessment phase. All participants were given exactly the same instruments. The only difference with the initial assessment phase was that they worked on a different topic from the one they worked initially for assessing integration performance. For example, if a participant completed an integration performance assessment on sun exposure (science topic) during the initial assessment phase, they would work on the cell phone topic (science topic) for the final assessment phase. The same held for the social topics. The participants in the control condition engaged in the same assessment procedure as those in the experimental condition and at the same time of the year, for both initial and final assessments.

4.2.1 Argument Skill

Participants' argument skill was assessed in writing (Iordanou et al., 2019; Kuhn et al., 2008) on a non-intervention topic addressing the issue of whether an elderly person's family or the government should be responsible for the care of elderly people (Kuhn, 2017). This measure was used as pre- and post-test measure. The participants were instructed to write a letter they would send to a local newspaper and asked that they be as convincing as possible. They were provided with nine pieces of evidence, supporting equally both positions, in the form of questions and answers that they could use to support their argument if they wished. An example of a piece of evidence provided was "How much does it cost to pay for the care of an elderly person in a long-term care facility? The average cost for one year at a private long-term care facility in the US is around $50,000. Such facilities are not always available,

especially in less developed countries." They were given as much time as they needed to complete their letters. The letters on average were 62 (*SD* = 51.35) words long.

4.2.2 Coding of Participants' Argument Skill at Initial and Final Assessment

One of the authors and a research assistant, blind to condition and time, segmented and coded the letters that students prepared at initial and final assessment on the transfer topic. The letters were segmented into idea units which consist of a claim and supporting justification. Only segments that included a claim and evidence served as the data base for further analyses. If there was no connection between the cited evidence and the claim, the unit was coded as non-functional. If the unit included a claim and a supporting (or weakening) piece of evidence connected to it, it was coded as a functional unit and it was further coded according to the type of function served (M+, M-, O+ and O-), employing the coding system used in previous work to assess students' argument skill (Iordanou et al., 2019; Kuhn et al., 2016). Inter-rater reliability on segmenting and coding was achieved on a subset of 30% of units, with 90% and 88% agreement, respectively. The research assistant proceeded with segmenting and coding the remaining essays, again blind to condition and time.

4.2.3 Integration of Multiple Source Perspectives

To assess participants' integration performance in each domain (Social and Science) two texts were used. The texts were designed to be similar in the content and structure and were administered, in counter-balanced order, in the initial and final assessment. The two social texts were on 1) bilingualism and its connection to cognitive abilities and 2) grades and their connection to learning. The science texts were on 1) sun exposure and health and 2) cell phones and health. The science texts were adapted from two texts originally published in Norwegian newspapers and journals, used by Bråten et al. (2013) and Bråten et al. (2014). The original texts were in Norwegian and were authentic sources from Norwegian newspapers and journals. The texts were provided to us in English by the researchers and were translated to Greek by us. The texts' difficulty level was adapted to be suitable for sixth graders. In relation to the cell phone and health topic, the first text was a 527-word text published in a science magazine. It mainly reported on an unpublished review article by an academic and brain surgeon who argues that cell phone use and brain tumours are linked and that radiation from wireless computer networks — which is similar to cell phone radiation —is harmful to our health. The second text was a 536-word text published in a newspaper which argued that those who claim that cell phone use can cause cancer exaggerate (Bråten et al., 2014). In relation to the sun exposure and health topic, the first text was a 406-word text published in an online research magazine by a group of educational institutions and showed evidence that exposure to sun can cause skin cancer and we should not sunbathe for obtaining vitamin D; instead, we can take supplements (Bråten et al., 2013). The second text was a 410-word text taken from a Norwegian conservative daily. It reported on a large-scale longitudinal study conducted in the US which showed that vitamin D can prevent the occurrence of cancer. Thus, since sun exposure is the natural means through which one gets this vitamin, the authors of the text recommend a 30-minute daily sun exposure (Bråten et al., 2013).

The social texts were developed by the authors by adapting and translating authentic texts found on blogs written by academics and professionals after getting all authors' written consent. The first text on bilingualism and its relation to cognition was a 404-word text adapted and translated from an article written by Bialystok (2017), arguing for the benefits of bilingualism in relation to bilinguals' cognitive skills. The second text was a 419-word text adapted and translated from an article written by Chatham (2007), arguing for the possibility that the reported benefits of bilingualism apply to a specific part of the population (those of a higher socioeconomic status). It also claimed a relationship between a higher socioeconomic status and children's cognitive abilities and stated that at least one study shows no advantage of bilingual children over monolingual ones. Regarding the topic of grades and their relation to learning, the first text was a 425-word text adapted from an article written by Travis (2017), arguing that grades help learning only when the standards according to which the grades are given are known and are clear to students. The second text was a 417-word text adapted from an article by Kohn (2010),

arguing for a world without grades, using as supporting evidence an example of a school that stopped giving grades to their students, who then improved their learning and academic performance.

Participants' integration of multiple source perspectives, thereafter, referred to as integration performance, was assessed using an approach that has been developed by Rukavina and Daneman (1996), Bråten et al. (2013) and Barzilai and Ka'adan (2016). The participants were asked to answer three open-ended questions. The first two questions indirectly required participants to integrate ideas from multiple information sources, assessing if participants integrate information from multiple sources without being prompted. The first question asked participants to explain the relation between key components examined in the texts, e.g., cell phones and health. The second question invited them to state their opinion on the controversial topic in question, e.g., their opinion on whether cell phones harm people's health. Finally, the third question directly requested to compare accounts, and state the differences between the two opposing views over the controversy in question. An example: "There are different views on the relationship between using a cell phone and health. Describe important differences between these views." In other words, the third question directly asked the participants to integrate perspectives from different sources (Rukavina & Daneman 1996, cited in Barzilai & Ka'adan, 2016).

4.2.4 Coding of Participants' Responses in Integration of Multiple Source Perspectives Instrument at Initial and Final Assessment

Participants' responses were coded based on an integration coding scheme employed by Barzilai and Ka'adan (2016) and Bråten and his colleagues (Bråten et al., 2013; Ferguson et al., 2013), which assesses the extent to which participants present and justify the contradictory positions represented in two texts and explicitly make connections between the two positions (see Appendix). The coding scheme rates the extent to which participants presented and justified multiple positions they found in the two texts they had at their disposal and the extent to which they connected those positions. Participants could receive up to six points for presenting and justifying the different positions put forward in the texts they read, with end points "0" when no position was presented regarding the inquiry question and "6" when two positions were presented with supporting reasons or explanations for both positions. For the second questions, that asked them to state their opinion on the controversial topic in question, participants' responses were scored based on whether they included alternative explanations, involving any explanations not necessarily the ones presented in the texts. In addition, they received up to two points for connecting those positions, a total of 8 points per question. In other words, the highest score one could get is eight points per question. The same codes were used for assessing the responses to all three questions. The final integration performance score was based on the sum of the scores on all three questions. Two coders – the authors – coded 40% of the data, blind to condition and time, with 88% agreement. The rest of the data were coded by one of the two coders, again blind to condition and time.

4.2.5 Coding of Participants' Integrative Events in the Electronic Dialogues During the Intervention

All the experimental condition's transcripts of the electronic dialogs that took place during the intervention were coded for evidence of integration. All dialogs were first segmented into the minimum idea units that served a specific function in the conversational exchange, such as expressing a simple agreement or providing a counterargument. Each idea unit was classified as to whether it included evidence (evidence-based idea unit) or not. Evidence-based idea units were further coded as to whether they integrated evidence from multiple sources or not. If they included evidence only from a single source, the idea unit was coded as "Single-source." An example of a "Single-source" idea unit coming from personal knowledge is " We believe that refugees should be accepted based on how difficult the conditions are in their country, because Christ taught us to love and help our fellow man regardless of our interests."

If they integrated evidence from different sources that we have provided in the form of Q&A evidence cards or from a combination of sources in the Q&A card and their personal knowledge, the idea unit was coded as "Multiple-source". Evidence that was not included in the sources that we provided was coded as evidence coming from a single source – personal knowledge. An example of an

idea unit that was coded as "Multiple-source" is the following "But fraudsters are not only the refugees, but also the locals, for example in the Netherlands there were 30 suspects not even confirmed among the thousands (of refugees that) had come. Even in France, where there were more refugees acclimatized than the natives, they lived much worse than the French. Like Yiannis Agianis (Jean Valjean), who lived in unfavorable living conditions." In that example, the student combined three pieces of evidence. The first two pieces were based on information provided in two different Q&A cards — one referring to the Netherlands that has identified 30 suspected war criminals among thousands of refugees who entered the country in 2015 and the other referring to a published study's findings showing that the share of immigrants in the population has no significant impact on crime rates once immigrants' economic circumstances are controlled for in France —, while the third one was based on student's personal knowledge from Victor Hugo's novel "Les Misérables." Two coders – the authors – blind to time, coded 40% of the data, with interrater agreement, 92%. Disagreements were resolved through discussion. The rest of the data were coded by one of the coders.

4.2.6 Prior Knowledge Test

Before the administration of the texts and the individual argument skill instrument, participants were given multiple-choice questions on each topic to assess their prior knowledge. Participants' prior knowledge was used to assess the equivalence of the four topics, because they received two of the texts, one from social domain and one from science domain, at initial assessment and the other two at the final assessment, in a counterbalanced order. All prior knowledge tests, except one, consisted of ten multiple-choice questions—only the test on grades tests consisted of six questions. Participants received one point for every right answer. The prior knowledge questions were designed by the researchers except those on the science topics which were formed based on the questions developed by Bråten et al. (2013) and Bråten et al. (2014) to assess prior knowledge.

4.3 The Intervention Phase

The participants in the experimental condition engaged in a dialogue-based argument curriculum over fourteen 80-minute sessions on the topic of immigration. These took place approximately twice per week over a period of three months. The participants in the control condition were taught about the same topic as part of the business-as-usual school curriculum which the topic was part of. In the school curriculum consideration of multiplicity of perspectives is not a standard practice for students of this age group. The experimental condition participants engaged in a series of electronic dialogs with their peers following the curriculum developed by Kuhn et al. (2008) and employed, thereafter, in many studies aiming to promote students' argument skill (e.g. Iordanou et al., 2019; Iordanou & Kuhn, 2020; Shi, 2020).

The participants in the experimental condition were introduced to the intervention topic by reading two texts which presented two different views on the criteria of accepting immigrants in one country. An introduction to the two texts posed the following question taken from Kuhn (2017, p. 7): "Should a nation allow people from other countries to come live in their country based on what they can contribute or how bad life is where they come from?" The two texts were developed by the researchers based on information found on valid sources regarding immigration. One text supported the view that immigrants should be accepted based on how bad life is in their home country; the other text supported that immigrants should be accepted based on what they contribute to the arriving country. The texts were equal in size (around 220 words). The participants were asked to take a position. Based on their position, two groups were formed: one group was in favor of the view that immigrants should be accepted based on how bad life is in their home country (need group) and the other was in favour of the position that immigrants should be accepted based on what they can contribute to the arriving country (contribution group). The two groups that were formed were approximately equal. Undecided participants were allocated to the group with the fewer participants so as to have close to equal number of students in each group. Figure 1 shows the experimental design of the study.

4.3.1 Preparation of Arguments

In the first session, the participants formed four small groups of 4-6 students sharing the same position and were asked to generate reasons supporting their position and note them on cards. Then they were requested to rank these reasons with respect to their strength. Adult coaches – the authors and the teacher – acted as facilitators in both classes in the experimental condition by encouraging participation of all group members. The cards prepared in this session remained available to participants during the argument chat sessions that followed.

4.3.2 Electronic Dialogs

The participants in each group ("need group" and "contribution group") were divided into same-side pairs and the members of each pair remained the same throughout these sessions. The participants engaged in eight electronic dialogs with a sequence of peers from the other group (sessions 2-9), holding an opposing position. These electronic dialogs with peers have the advantage of providing students with the opportunity to get extensive experience in engagement in dialog, unlike classroom-based discussions when many students engaged in the same dialog. Dialogues were conducted on tablets, provided by the researchers, via an instant messaging software, in students' classroom. The transcripts of the dialogues were saved and used later for analysis. The participants were instructed to convince the opposing pair about their position. Each pair was further instructed to collaborate with their partner to decide what they wished to say to the opposing pair and, once they were in agreement, to send their response to the opposing pair. Two adult coaches (one of the authors and the teacher who received training) provided help with technical issues and reminded pairs to collaborate in responding to what the opposing team was saying.

During these sessions, the participants had at their disposal pieces of information and evidence that they could use if they wished to. All evidence provided to them was in the form of question and answer, following the recommendation of Iordanou et al. (2019) who showed that this is a more effective way to promote evidence use in argumentation compared to providing information in the context of a traditional text. Some questions were developed based on questions in Kuhn (2017 pp. 179–182) while others were developed by the authors. The answers provided were based on reliable sources with the source provided under each answer. All in all, eight different sets of three questions-answers were formed. Participants received one set in each session which remained available to them in the subsequent sessions. Students received evidence supporting their own view (M+, n=7), evidence weakening their own view (M-; n=5), evidence supporting the opposing view (O+; n=7) and evidence weakening the opposing view (O-; n=5).

In addition, participants in the last 3 sessions were asked to reflect on the transcript of their dialogue using reflection sheets. One reflection sheet asked participants to reflect on the effectiveness of a counterargument they offered to the opposing side's argument while the other encouraged them to reflect on a rebuttal they offered to opponents' counterargument, and in both cases to consider possible improvements.

4.3.3 Preparation for the 'Showdown'

In sessions 10-11, participants prepared for the Showdown for which they knew they would compete and there would be a winning team. The class was divided into four same-side preparation teams. The teams were given all the reflection sheets that their members had already prepared along with the evidence provided to them during the chat sessions and a printed copy of the transcripts of the dialogs they had. They were then asked first to reflect on all of these and prepare two different kinds of sets of cards. The first set consisted of two cards: Other's argument – Counterargument and the other

set consisted of three cards: Own argument-Counterargument provided by the other side-Own Rebuttal. Each part of the sequence was noted in a different coloured card, providing a visual representation of the sequence. All groups were assisted by three adult coaches in both schools (one teacher and the two researchers).

4.3.4 "Showdown" and Feedback

In the next session (session 12), students had an electronic showdown. Working toward the social objective of the showdown, previous work has shown (Kuhn et al., 2008) to have motivating and focusing effects on students. All participants supporting the same side of the topic were placed in one room with the students supporting the other side being in another room. Then, the participants on each side of the topic were divided into two teams (Team A and Team B). Each team was given 20 minutes to debate on the topic with their corresponding opposing team that was in another room. The two sides communicated through the computer and their dialogue was projected onto a whiteboard. All members collaborated to reach an agreement on the text to be sent to the opposing side. During the first half of the showdown, the A team members debated while the B team members were watching the debate and offered suggestions in writing to the A team members if they wished. At half-time, teams switched roles and the B team members continued the debate. The showdown thus consisted of a single 40-minute electronic dialogue between the two opposing sides.

Following the electronic Showdown (session 13), students received feedback and a winning team was declared. The electronic dialogue produced in the showdown was presented to them in an argument map prepared by the researchers. Different columns appeared for each team, with their contributions arranged in order of occurrence from top to bottom. All statements were represented and connected by lines to show their interrelation. Different colours were used to label statements as effective, ineffective, or neutral argumentive moves. Points were assigned for each counter-argument the students produced and for each piece of evidence they used to support their argument in order to declare the winners.

In the last session (session 14), a live, face-to-face showdown was pursued, which participants' parents were invited to watch, using the same rules described for the electronic showdown above.

4.3.5. Fidelity

To ensure fidelity of treatment, the first author prepared a detailed intervention protocol, including lesson plans and assessment guidelines, that was provided to the second author and the teachers of the experimental condition. The second author coordinated the implementation of the intervention in both classes in the experimental condition and was present in all sessions. The classroom teachers acted as facilitators, following closely the guidelines set out in the intervention protocol. The first author attended about half of the sessions and had regular meetings with the teachers and the second author before and after each session. In addition, the sessions were video recorded to monitor treatment fidelity. An independent researcher and the first author, who coded the videos, confirmed that the sessions adhered to the intervention protocol. The assessment of the control condition students was pursued by another research assistant, with experience in administering assessment instruments, following the same assessment guidelines described in the protocol and after communication with the first author.

5 Results

5.1 Argument skill at Initial and Final Assessment

To examine whether there were any statistically significant differences between the experimental and control groups at the outset of the study so as to ensure that participants were equivalent, we compared experimental and control condition participants' skill in using evidence to weaken others' position, an advanced argument skill. A Kruskal-Wallis H test showed that there was no statistically significant difference in argument skill – advanced skill of using evidence to weaken others' position, O-, – between the experimental and control groups at initial assessment, $\chi^2(1)=.744$, $p=.388$.

A GLMM using the Poisson distribution, examining condition differences over time in argument skill, showed a difference between groups in weaken-other usage in the transfer topic, $F(1, 138)=8.032$, $p=.005$. The interaction between group and time was significant, $F(1, 138) = 12.506$, $p=.001$. The fixed effect of time was significant, $F(1, 138)=15.935$, $p< .001$, as well as the fixed effect of group, $F(1, 138) = 8.032$, $p=.005$. Students in the experimental condition showed an increase in the number of Weaken-other units, from 0.083 (*SD*=0.050), 95% CI [-.15, .182] to 1.028 (*SD*=.212), 95% CI [.608, 1.447], while students in the control condition showed a more limited increase, from 0.171 (*SD*=0.72), 95% CI [.028, .314], to 0.229 (*SD*=0.101), 95% CI [.028, .429].

5.2 Integration performance at Initial and Final Assessment

First, we examined whether there were any statistically significant differences between the experimental and control groups at the outset of the study to ensure that students in the Experimental and Control conditions performed equivalently. Data were also examined for outliers and these were ruled out. A MANOVA comparing conditions, with the integration performance score in the social domain and the science domain as dependent variables, failed to achieve statistically significant difference, $F(2, 61) = 0.025$, $p = .975$; Wilk's $\Lambda = 0.999$, $\eta_p^2 = .001$.

Because the Bilingualism topic and Grades topic for the social domain, and the Cell Phone use topic and Sun Exposure topic for the science domain, were counterbalanced in the pre-test and post-test, we examined participants' prior topic knowledge about these four topics in order to assess their equivalence. A MANOVA comparing conditions with the four topic knowledge variables as dependent variables failed to achieve statistically significant difference, $F(4, 59) = 1.092$, $p = .369$; Wilk's $\Lambda = 0.931$, $\eta_p^2 = .069$. Experimental and control condition students showed comparable prior knowledge in all the four topics, Bilingualism (*M*=5.529, *SD*=1.942, and *M*=5.800, *SD*=1.648), Grades (*M*=3.088, *SD*=1.264 and *M*=3.000, *SD*=1.232), Cell Phone use (*M*=4.441, *SD*=1.691 and *M*=3.933, *SD*=1.530) and Sun Exposure (*M*=4.618, *SD*=1.723 and *M*=3.967, *SD*=1.691). No statistically significant difference in prior knowledge scores was observed among the 4 classes which took part in the study, either, $F(12, 151) = 1.348$, $p = .197$; Wilk's $\Lambda = 0.764$, $\eta_p^2 = .086$.

A 2 (Condition) X 2 (Time) repeated-measures analysis of variance (ANOVA) comparing the two conditions was used to assess whether the conditions had differential effects on integration skills. On the Social topic, a significant Time X Condition interaction was observed, $F(1, 62)=6.949$, $p=.011$, $\eta_p^2 = .101$. Experimental condition students, as seen in Figure 1, doubled their integration score from initial (*M*=3.882, *SD*=3.444) to final assessment (*M*=6.647, *SD*=4.081), while control condition students showed no significant difference from initial (*M*=3.733, *SD*=2.258) to final assessment (*M*=3.666, *SD*=2.795).

On the Science Topic, a significant Time X Condition interaction was also observed, $F(1, 62)=10.596$, $p=.002$, $\eta_p^2=.146$. Experimental group participants showed a significant increase in their integration score, from 5.588 (*SD*=3.276) to 7.971 (*SD*=4.448) (see Figure 2). No significant difference was observed in control group participants, from initial (*M*=5.633; *SD*=2.220), to final assessment (*M*=4.733; *SD*=2.664).

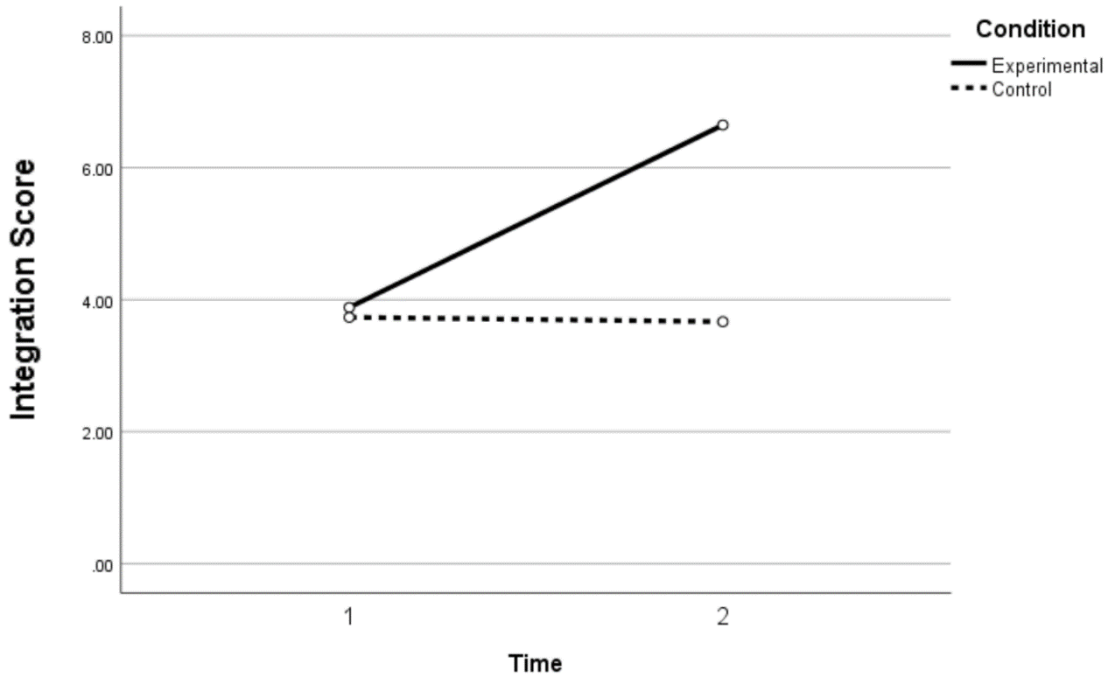

Figure 1. Experimental and Control Condition students' Integration of Multiple Source Perspectives on the Social Domain, from Initial to Final Assessment

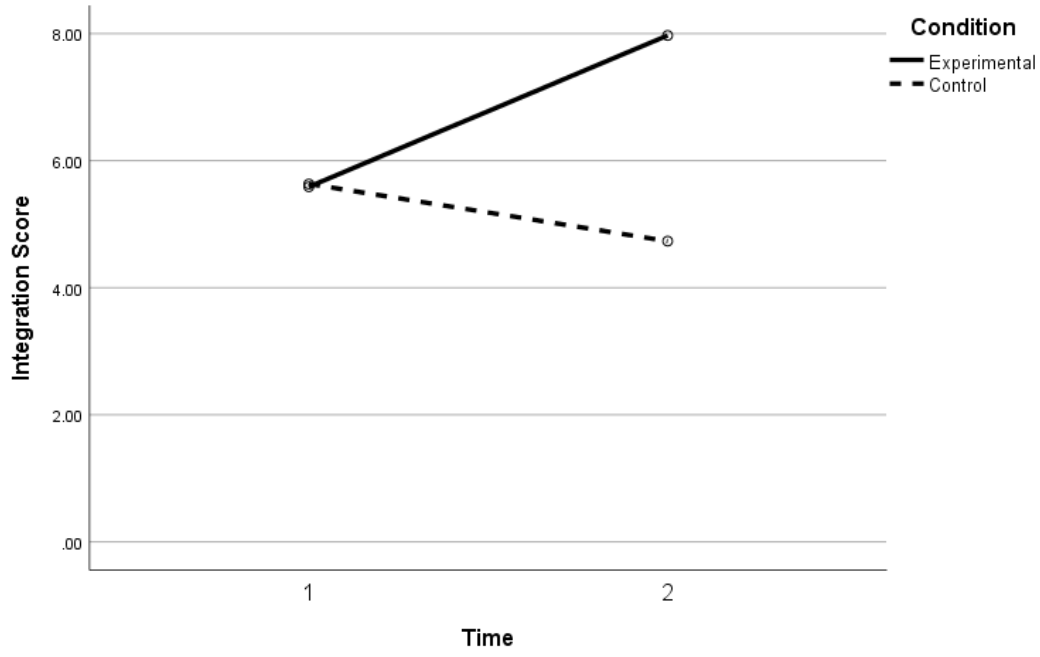

Figure 2. Experimental and Control Condition Students' Integration of Multiple Source Perspectives on the Science Domain, from Initial to Final Assessment

5.3 Integration During the Intervention

The microgenetic method was employed to examine the process of change during the intervention. The number of idea units per session was different, ranging from *M*=7.300 (*SD*=2.830) to *M*=14.555 (*SD*=4.666), because of variations in time available due to school curriculum or technology restrictions (e.g. unexpected internet connectivity issues), therefore, we used percentages to examine possible differences during the intervention. Evidence-based idea units ranged from *M*=4.900 (*SD*=1.969) to *M*=9.800 (*SD*=3.881). The percentage of evidence-based idea units that included integration of evidence from multiple sources, as opposed to using evidence from a single source is depicted in Figure 3. As can be seen in Figure 3, there was an increasing pattern of integrating multiple sources in students' arguments from Dialog session 1 (*M*=6.455, *SD*=9.759) to Dialog session 8 (*M*=17.010, *SD*=10.777), showing that the integration skill was slowly developing during engagement in argumentation in the context of the intervention.

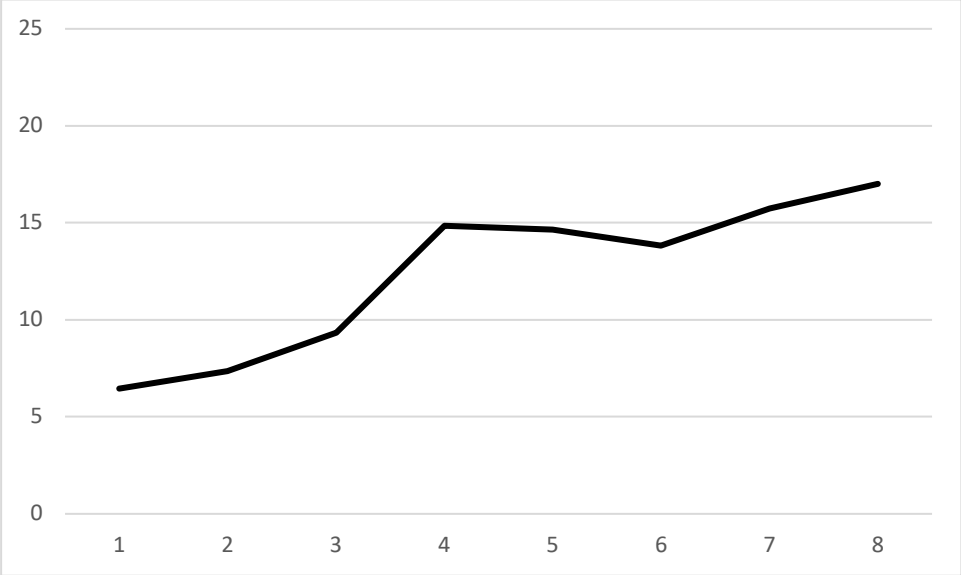

Figure 3. Percentage of Evidence-Based Idea Units Which Included Integration of Evidence from Multiple Sources, Throughout the Intervention

6 Discussion

We examined the effectiveness of engagement in dialogic argumentation on its ability to promote integration of multiple source perspectives from multiple texts in argumentive writing. Results revealed that participants who engaged in a dialog-based argumentive intervention improved their integration of multiple source perspectives in argumentive writing, whereas participants who engaged in their business-as-usual curriculum did not show any improvement. Our findings are consistent with Wiley and Voss (1999) who found that engagement in argument construction supports better integration of information when writing arguments.

What accounts for the experimental group's gains? What needs to be considered when seeking an explanation for the condition effects is the fact that gains in integration of multiple source perspectives in argumentive writing were confined to those in the experimental condition who engaged in argumentive discussions with peers who hold and supported with arguments an opposing position on

the main topic. Experimental condition participants showed better multiple source perspective integration compared to both their initial assessment performance and the performance of the control group, who was assessed at the same time points as the experimental group but attended their regular school curriculum. Noteworthily, gains in integration of multiple source perspectives in argumentive writing were also transferable. Experimental group participants not only showed gains in integration of multiple source perspectives in argumentive writing in a new topic in the same domain that they had their intervention on – the social science domain – they also exhibited far transfer of their integration of multiple source perspectives gains to a different, non-intervention, domain, namely the physical science domain. Why did this transfer of integration of multiple source perspectives occur and why did the experimental group show an advantage in this regard? The explanation of what accounts for the gains observed is not obvious, given that participants did not receive any direct instruction on multiple source perspectives. We propose that engagement in argumentive dialog supported experimental group participants to learn something they were then able to apply to a new task, a new topic and a different domain – something such as an understanding that there are alternative perspectives on an issue. Although this understanding of recognizing different interpretations of an issue seems simple, it is not a developmental achievement that we should take for granted (Iordanou, 2016a; Lalonde & Chandler, 2002). Yet, recognizing alternative positions on an issue is fundamental for multiple-text comprehension (Britt & Rouet, 2012; Kuhn, 2020; List & Alexander, 2019). Engaging in dialogic argumentation where a contrasting perspective is embodied in a "real" person, as did our experimental condition, may have supported this understanding. When ideas are personally represented, receivers' thinking about the issue benefit more, probably by emphasizing that there indeed exists a flesh-and-blood other who supports such views (Iordanou & Kuhn, 2020; Mill, 1859/1996). Engagement in dialogic argumentation with individuals who hold different positions from one's own on a particular issue, has the added benefit of providing a personal representation of views, in addition to offering exposure to divergent information which previous research shows impacts epistemic understanding (Ferguson & Bråten, 2013; Ferguson et al., 2013; Kienhues et al., 2011). Dialogic argumentation provides the "interlocutor" which is missing and needs one to envision when reading multiple documents. Indeed, previous research showed that identifying perspectives in informational texts is more challenging than identifying perspectives in everyday social interactions (Jucks & Bromme, 2011; Kim et al., 2018). Understanding alternative perspectives on an issue is an important epistemic achievement fundamental for appreciating the diversity and complexity of knowledge (Barzilai & Weinstock, 2020). The lack of direct measures for assessing students' epistemic beliefs, which constitutes a limitation of the current study, does not enable us to draw definite conclusions regarding epistemic gains. Future research needs to explore this possible interpretation further by measuring students' epistemic beliefs. Also, further work is warranted, using other modes of discussion and topics to examine the generalizability of the suggestive gains observed in this study.

Our microgenetic data show that the skill of integrating information from multiple sources developed gradually over time while individuals were engaged in dialogic argumentation, providing further evidence of the claim that engagement in dialogic argumentation supports integration skills. The microgenetic data show that during engagement in dialogic argumentation students exhibited a progression in combining evidence from multiple sources in their arguments. This progression is slow and extends over time, suggesting that sustained engagement in dialogic argumentation over time provides facilitative conditions for developing the skill of integrating multiple perspectives. The condition differences observed in the argumentive strategy of using counterarguments, which focuses directly on an other's position in an effort to weaken it, also supports this interpretation. Experimental group participants, but not control group participants, after their engagement in dialogic argumentation exhibited improvements in their ability to use evidence to weaken the other's position, a finding which is consistent with previous empirical work (Iordanou et al., 2019; Kuhn & Crowell, 2011; Mayweg-Paus et al., 2016) and shows an implicit recognition of the value of paying attention to the other's opposing position. The findings of the microgenetic study, showing gains in integration from multiple sources during the course of dialogic argumentation, which remained evident in argumentive writing after reading multiple texts in the absence of social support, are in line with the sociocognitive and

sociocultural theories (Piaget, 1928; Vygotsky, 1978) according to which social interaction facilitates the development of reasoning skills which develop first on the social plane and then they become internalized. The unique contribution of the present work is in providing evidence of the power of engagement in a dialog-based argumentive intervention for promoting individuals' ability to incorporate multiple perspectives in writing an essay after reading multiple texts on non-intervention topics.

Appreciating alternative perspectives might have supported students both during the process of reading multiple texts – given that the ability to identify the views presented in different texts as discrepant is fundamental for multiple text understanding (Britt & Rouet, 2012; Kuhn, 2020; List & Alexander, 2019) – and while they engaged in the argumentive writing task after reading controversial multiple texts. Our findings have important educational implications. They extend previous findings which showed that dealing with conflicting information about an issue support an epistemic understanding of appreciating the imprecise nature of knowledge (Kienhues, Stadtler, & Bromme, 2011). Our work shows that in addition to dealing with conflicting information about an issue, engagement in purposeful dialogic argumentation with individuals who represent alternative positions about an issue (Iordanou & Kuhn, 2020), along with reflection on argumentation, facilitates students' skill of integrating multiple source perspectives from multiple texts on an issue. Students' engagement in direct debate with one another, rather than using the teacher as the channel through which discourse flows, seems to facilitate the development of students' argument skills. Our microgenetic data suggest that this development is gradual, therefore providing students multiple opportunities in the school curriculum for sustained engagement and practice, over successive occasions, is another condition that needs to be taken into consideration in curriculum development and teaching practice. In a nutshell, the present work shows that engagement in dialogic argumentation is a promising pathway for supporting acknowledgment and integration of multiple source perspectives both when writing essays but also when engaged in argumentive writing after reading multiple controversial texts.

Keypoints

- Engagement in dialogic argumentation supports the ability to integrate multiple source perspectives from multiple texts.
- Microgenetic data revealed a progressive development of participants' integration skill throughout their engagement in the argumentive discourse activity.
- A control group which engaged in business-as-usual school curriculum showed no improvement over time in integrating multiple source perspectives.
- Engagement in dialogic argumentation supported development of participants' argument skills.
- The gains observed in integrating multiple source perspectives showed far transfer, to a different domain.

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Figure 1

Outline of the Study Design

Experimental Group	Control Group
Initial Assessment a. Prior-Knowledge Test b. Argument Skill (non-Intervention Topic) c. Integration of Multiple Source Perspectives (Social & Science*)	**Initial Assessment** a. Prior-Knowledge Test b. Argument Skill (non-Intervention Topic) c. Integration of Multiple Source Perspectives (Social & Science*)
Intervention Session(s) Supporting reasons with evidence 1 E-Chat 2-6 E-Chat & Reflection 7-9 Preparation for Showdown 10-11 E-Showdown 12 Feedback 13 F2F Showdown 14	Business-as-usual school curriculum
Final Assessment a. Prior-Knowledge Test b. Argument Skill (non-Intervention Topic) c. Integration of Multiple Source Perspectives (Social & Science*)	**Final Assessment** a. Prior-Knowledge Test b. Argument Skill (non-Intervention Topic) c. Integration of Multiple Source Perspectives (Social & Science*)

*Note: The topics were counter-balanced.

Appendix

Coding Scheme of Multiple Source Perspectives

Code	Description	Example(s) from the dataset	Score
Presenting and justifying multiple positions			0–6
No position	No position is presented regarding the inquiry questions.	1) I don't know (what to write). 2) Young children only know one language and when they grow older, they learn another one. A cognitive ability relates to jobs, financial problems, etc.	0
Single position	A single position is presented without a supporting reason or an explanation.	My opinion is that bilingualism helps our cognitive abilities.	1
Single position with own justification	A single position is presented with a supporting reason or an explanation.	The decline in one's cognitive abilities that occurs as we age is slower in bilinguals and the symptoms of dementia are delayed for 4–5 years.	2
Single position with justification and qualification	A single position is presented with a supporting reason or an explanation and a qualification that conditionalizes the position.	My opinion is that if someone is exposed to the sun at the right time of the day, from 12:00 till 14:00, and puts on sunscreen with a high sun protection factor, they will be ok; but always in moderation.	3
Two positions	Two positions are presented without reasons or explanations.	The first text talks about serious problems (in relation to cell phone use) while the second says that these might be exaggerations.	4
Two positions with one-sided, justification	Two positions are presented with a supporting reason or explanation for one position only.	Based on some studies (which according to my opinion are wrong) bilingual children have more cognitive abilities than monolingual children. Another study, however, showed that bilingual children come from rich families who can spend a lot of money on their education.	5
Two positions with two-sided justification	Two positions are presented with supporting reasons or explanations for both positions.	One side says that the sun is good for us due to the Vitamin D that it provide us and due to the fact that we have less chance of getting cancer if we are exposed to the sun. The other side says that the sun is very bad for us because of the UV radiation. In fact, they say that we have more chances of getting cancer if we are exposed to the sun because our skin and internal organs can't handle it.	6
Connecting positions			0-2

No explicit connection	No relation between the positions is explicitly stated; they are not presented as contrastive in any way.	The sun causes both illness and health.	0
Positions connected	Positions are explicitly related to each other or compared and contrasted *for example with the use of contrastive conjunctions, by making reference to the different sources.*[1]	One view, according to Fisher, refers to the fact that various scientists recommend sunbathing so as to obtain vitamin D. He warns people that this is problematic. Another view is that those who had high levels of vitamin D in their meals and were active had less chances of getting cancer. The differences between these views are that in the first one Fisher warns us that it is not ok to sunbathe so as to get vitamin D while the other view says that those who had higher levels of vitamin D they acquired it through their meals and by having an active lifestyle.	1
Positions reconciled	Positions are reconciled by providing an explanation for the differences between them and/or by drawing a conclusion based on consideration of both positions.	One difference is that they will learn from their grades (and their mistakes), but if they don't receive grades they will not learn from their mistakes. However, if they don't receive any grade, it will still be helpful because getting feedback is a more helpful strategy and gives better results; however, this holds only if this system is implemented correctly.	2

[1] The part in italics is our addition to the coding scheme. This was done so that we make more explicit how we have implemented this criterion.