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Arguing collaboratively: Argumentative discourse types and their potential for knowledge building

Mark Felton[1], Merce Garcia-Mila[2], Constanza Villarroel[2], and Sandra Gilabert[3]

[1] Lurie College of Education, San José State University

[2] Department of Developmental and Educational Psychology, Universitat de Barcelona

[3] School of Education, Universitat Rovira i Virgili

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Correspondence should be addressed to:

Mark K. Felton

Lurie College of Education

San Jose State University

1 Washington Square

San Jose, CA 95192-0077

mark.felton@sjsu.edu

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***Background**. There is growing interest in using argumentative discourse in educational settings. However, in a previous study, we found that discourse goals (persuasion vs. consensus) while arguing can affect student outcomes in both content learning and reasoning.*

***Aims**. In the present study, we look at argumentative discourse data from a previous study to ask how differences in discourse might account for the differences we observed in learning and reasoning outcomes.*

***Sample**. One-hundred-five dialogues (57 disputative, 48 consensus) between 7th grade science students attending a public high school near Tarragona, Spain.*

***Methods**. Participants were randomly assigned to conditions and paired with peers who disagreed with them on three topics related to renewable energy sources. After instruction on each topic they were asked to either "argue to convince" (persuasion condition) or "argue to reach consensus" (consensus condition) on that topic. Conversations were audio recorded and transcribed for analysis.*

***Results**. Students in the persuasion condition engaged in shorter conversational exchanges around argumentative claims and were more likely to use moves that foreclosed discussion, whereas students in the consensus condition and were more likely to use moves that elicited, elaborated on and integrated their partners' ideas.*

***Conclusions**. When arguing to reach—rather than defend--a conclusion, students are more likely to co-construct knowledge by exchanging and integrating arguments. These findings are consistent with predictions about the potential of argumentation for knowledge building and suggest that teachers must attend to discourse goals when using argumentation to support learning and reasoning.*

Background

Across a range of academic disciplines, there is growing interest in using argumentative discourse to promote learning and reasoning in schools (Osborne, 2010; Hess, 2009; Keefer, Zeitz & Resnick, 2000; Yackel & Cobb, 1996). This interest stems from a variety of advantages that argumentative discourse presents for learning, including increased engagement in conceptual learning (Nussbaum & Sinatra, 2003), the opportunity to develop disciplinary thinking skills (Garcia-Mila & Anderson, 2007), and the active production of knowledge (Andriessen, 2007; Driver, Asoko, Scott, Leach & Mortimer, 1994; Howe, 2014; Leitão, 2000). But to harness its pedagogical power, it is important to understand how argumentative discourse promotes learning and reasoning and the conditions under which it is most effective.

According to Mercier and Sperber (2011) argumentative discourse serves two fundamental communicative functions: To convince others to accept an argument (persuade) and to assess arguments posed by others (deliberate). They propose that value of argumentative reasoning is best understood not as a form of independent thinking, given the well-documented flaws and biases in our decision-making, but instead as a context for the social exchange of views. In the social context, argumentative discourse offers the potential dual-benefits of exposure to alternative arguments (increasing our access to ideas and information) and the opportunity to critically examine opposing arguments to optimize decision-making. But argumentative discourse can provide more than the opportunity to advance or reflect on arguments in groups and potentially extends to a third, related function. As we advance and examine conflicting claims and evidence through discourse, we have the opportunity to collaborate with others to integrate our knowledge and refine our collective understanding (Asterhan & Schwartz, 2007; Mercer, 2000; Resnick, Salmon, Zeitz, Wathan & Holowchak, 1993). Discussing alternative arguments and counterarguments establishes a dialectical exchange, which under certain conditions opens the door to subtle shifts in our thinking (Billig, 1996) from qualifications

of our original position to withdrawal of an argument. Working in tandem with a friendly critic, we have the opportunity to co-construct new arguments that integrate valid points from multiple perspectives to develop more reasoned, refined and robust conclusions (Leitão, 2000). Understood in this way, argumentative discourse becomes a context for the social construction of knowledge and a catalyst for collaborative learning.

Researchers have referred to this kind of co-constructive argumentative discourse as collaborative argument (Golanics & Nussbaum, 2008; Nussbaum, 2008), collective argumentation (Brown & Renshaw, 2000), critical discussion (Keefer, Zeitz & Resnick, 2000) and exploratory talk (Mercer, 2000). And while these constructs differ in many ways, particularly in context and the methods by which they were studied, they do share several defining features. All involve the exchange of competing ideas, the critical examination of these ideas and the social negotiation of meaning. They have also all provided evidence of the positive effects of argumentative discourse to promote more rigorous thinking and more effective learning in laboratory and classroom settings. And yet, despite evidence of the benefits of argumentative discourse for learning and reasoning, it is not difficult to cite instances where public dialogue sinks well below any standards of effective persuasion and reasoned deliberation. In fact, some of the same flaws and biases found in individual reasoning can be provoked or even amplified by argumentative discourse (Ferretti, MacArthur & Dowdy, 2000; Nussbaum & Kardash, 2005; Wolfe & Britt, 2008).

Argumentative discourse goals

One way to resolve the apparent contradiction in the empirical literature is to recognize the natural tension between the persuasive and deliberative functions of argumentative discourse. According to Walton (2010) arguments must be understood not only in terms of their logical structure, but also by the purposes to which they are put. In persuasion dialogue, we argue to convince, whereas

in deliberation dialogue, we argue to decide. These distinct goals, in turn, impact both the norms and the nature of engagement. Persuasion dialogue is an adversarial exchange in which speakers advance incompatible claims with the goal of convincing others to accept their claim. In some situations speakers may be motivated to dismiss or even suppress effective opposing arguments and critiques in the interest of advancing their own position. There is evidence from the psychological literature to support this claim. Wolfe and Britt (2008) have found that although individuals will search through text on both sides of an issue when preparing a persuasive essay, they withhold opposing-side claims and evidence when subsequently asked to craft an argument. Importantly, these effects hold even when participants are asked to play the devil's advocate and write a persuasive essay that goes against their own true position on an issue. In a similar vein, Nussbaum and Kardash (2005) have found that individuals will fail to present and rebut opposing-side arguments when asked to persuade, but will include these elements of argument when explicitly prompted to do so (see also Ferretti, MacArthur & Dowdy 2000). These findings suggest that the omission of opposing-side arguments stems less from a biased search or a lack of empathy for opposing-side arguments and more from beliefs about how to craft an effective persuasive argument.

In contrast to persuasion, deliberation dialogue is a collaborative exchange in which speakers hold incompatible claims and seek to resolve these differences to arrive at a consensual decision. As with persuasion dialogue, deliberation dialogue includes a stage in which speakers introduce and critically examine opposing arguments (Walton & Krabbe, 1995). However, deliberation dialogue requires an additional activity in the argumentation stage, which Walton labels "revision," whereby proposals and views are adapted in light of incoming arguments and evidence (Walton, 2010). This collaborative activity creates the motivation and opportunity for argument-counterargument integration in argumentative discourse. Again there is evidence to support this proposal. Crowell, Felton and Liu (2014) have found that college students are more likely to cite arguments that originated from their

peers and are more likely to integrate arguments with counterarguments when they have been asked to argue to reach consensus in a chat with a peer than when they have been asked to argue to persuade a peer. In this case, goal instructions, manipulated to contrast directly the effects of persuasion dialogue with deliberation dialogue, had a clear impact on the quality of arguments written immediately afterwards. Thus the extant literature suggests that discourse goals have a direct influence on the integration of arguments and counterargument when individuals write after arguing.

There is also evidence that discourse goals affect the degree to which individuals learn content of the arguments they discuss. In a recent study [the authors] (2009) found that argumentative discourse goals (again, arguing to persuade vs. arguing to reach consensus) had an impact not only on the quality of participants' written arguments from pretest to posttest, but also on learning the content that formed the reasons and evidence supporting conclusions on either side of an issue. The study was run in a middle-school science curriculum unit on renewable energy sources and their relative advantages with respect to energy production, cost, efficiency and environmental impact. Adolescents in the two discourse conditions received instruction on content related to teach topic of discussion and engaged in three different dialogues with peers. Students in the consensus condition produced more complex, two-sided essays in support of their positions and also learned content related to the pros and cons of the energy sources better than their peers in the persuasion-goal condition even when exposure to content was controlled for through instruction. These findings suggest that the discourse goals in the two conditions impacted both argument quality and content learning at the posttest. A subsequent study of the data (Authors, 2013) revealed that more complex argument structures were co-constructed in these dialogues. However, dialogue data from the study were not analyzed to search for the mechanisms by which the learning outcomes may have unfolded.

The Present Study

In the present study, we return to the data from this previous investigation (Authors, 2009) to look more closely at the characteristics of the students' argumentative discourse. Here we focus on the nature of dialogue in each condition to look for evidence of persuasion and deliberation dialogue. As an intervention validation, we examine whether the task goals in that study indeed produced these two forms of discourse. If we cannot find discernible differences in discourse, then other variables associated with task goals would have to be explored to explain student learning outcomes. However, if differences are found in the kinds of discourse, it would be useful to examine discourse patterns to get a better understanding of the mechanisms by which task goals (to persuade *vs.* to reach consensus) lead to between-group differences that to differences in learning.

Research questions:

(1) Did our two discourse goal conditions ("argue to persuade" vs. "argue to reach consensus") produce significantly different types of discourse during our intervention? If so, how did they differ?

(2) What do between-group differences in discourse tell us about the relative advantages that arguing to reach consensus provides for learning?

METHODS

Design

A between-subjects design was used to compare the effects of task instructions on argumentative discourse. The instruction of the task presented two levels: (1) a consensus condition, where students

were prompted to argue to reach consensus; (2) a persuasion condition, where students were prompted to argue to convince the partner.

Participants

Participants were 7th grade science students attending a public high school near Tarragona, Spain. The participants' mean age was 12.2 (SD=0.4) (range 12.0-13.0). Students were proportionally pooled from five classes and randomly assigned to conditions. Dyads were formed according to two criteria: First, they had to disagree in each of the three dilemmas they were presented, so the partners in the dyad could be rearranged according to this criterion; second they had to belong to the same condition throughout the entire intervention. Thus, the unit of analysis is the dyad. The sample is formed by 105 dialogues (57 disputative and 48 consensus).

Procedure

The intervention comprised 8 fifty-minute sessions on the topic of climate change and renewable energies. Students were told that over the course of three mini-units, they would learn about various energy sources, discuss them with peers and eventually propose a new energy plan for their city. In the first session, the curriculum was introduced and students took a pretest. In session two through seven, students went through three two-day mini-units, each dedicated to a dilemma (thermal vs. nuclear energy, wind or not, and biodiesel or not). On the first day of each mini-unit, students learned content related to the week's dilemma and then wrote a short essay taking a position on the dilemmas. On the second day of each mini-unit, students in the two discourse conditions were paired with a disagreeing partner and the two were asked to discuss the dilemma with the goal of either persuading their partner (persuasion condition) or reaching an agreement (consensus condition). Finally, at the end of session 8, all the students took a posttest in which they answered content

questions from each mini-unit and wrote an essay supporting their energy plan for the city. All the discussion sessions were audio taped and transcribed for analysis.

Instruments

Analytic scheme for argumentative discourse. To answer the research questions, we have adapted a coding scheme developed for argumentative discourse (Felton & Kuhn, 2001; Felton, 2004). That scheme was originally developed to analyze argument in persuasive contexts, so we have adapted the scheme to make it more sensitive to the more collaborative forms of argument that one might expect to encounter when individuals argue to reach consensus (see Appendix A). For each conversational turn in a dialogue, raters assigned one or more codes to represent the communicative function of that utterance. When raters disagreed on the number of codes in a given turn, the higher number was added to the total number of codes and the disagreement was added to the tally. Raters then resolved any disagreements by discussion before moving on to the next conversational turn. Inter-rater reliability, tallied using 25% of the total dataset, was 0.821 (Cohen's κ).

The first wave of data analysis focused on the proportional use of argumentative moves in each condition. Simple frequencies for each move in a dialogue were tallied and divided by the total number of coded moves in each dialogue to calculate proportions. Next, data were analyzed for the relative length of argumentative exchanges in each dialogue. An argumentative exchange is defined as a sequence of transactive turns in a dialogue, which ends when one of the two speakers introduces an unconnected question or statement. An exchange can be understood as the total number of turns that conversational participants take before moving on to another claim for discussion. The length of exchanges (corrected for repetitions of argumentative moves and meta-conversational talk) can be used as a rough indicator of the depth to which a pair has discussed a claim before moving on.

Analytic scheme for meta-conversational talk. Meta-conversational talk (*Meta-talk*) refers to dialogue that departs from the topic of discussion to address the discussion, itself, or the speakers in the discussion. Because meta-talk comprised a large proportion of the coded dialogue with significant between-group differences, a new scheme was developed to categorize these moves for further analysis. All instances of meta-talk were re-coded using a refined coding scheme by researchers blind to the dialogue conditions (see Appendix B). Three broad categories were developed to capture whether meta-talk addressed the goals of the dialogue (meta-goal), reasoning and the exchange of claims in the dialogue (meta-reasoning) or the procedural elements of the dialogue (meta-procedural). Each of these categories was divided subcategories developed from the data and finally each subcategory was divided into productive talk, which focused on positively engaging the partner or promoting the exchange of ideas, and counterproductive talk, which focused on negatively engaging the partner or foreclosing the exchange of ideas. Again, two scorers, blind to the condition and identity of participants, coded the complete dataset of meta-talk. Interrater reliability for the meta-talk coding scheme, calculated using 25% of the dataset, was 0.817 (Cohen's κ).

RESULTS

Analysis of discourse data. The only move that was normally distributed was *meta,* and we used the Students' t-test for means comparison. For the rest of the statistical comparisons we used the Wilcoxon tests. In order reduce the risk of Type I error accumulation, we excluded from the statistical analysis those moves with means that were below the 50th percentile (i.e., with means lower than .009). Table 1 shows the means and standard deviations of the 22 argumentative moves that were analyzed. Correcting for Bonferroni on these 22 tests we considered p-values that were less than .0023 (or .05/22) as significant. In the right column we indicate the condition that had a

higher mean. *Counter-UC (counter unjustified critique)*, *Disagree,* and *Meta* were the only three moves whose mean was significantly higher in the persuasion condition, while *Accept, Accommodate-PQ, Advance, and Recap* had significantly higher means in the consensus condition. Means (and SD) for *Counter-UC* for the consensus and the persuasion condition were 0.0504 (0.039) and 0.0155 (0.019), respectively, *W*=1552*, p*=.001 (effect size *r*= .492). For *Meta,* means were 0.1497 (.077) and 0.0863 (.070), *t* (96) =4.2*, p* =.001 (effect size *d*=.969) for the persuasion and consensus conditions, respectively. For those moves whose means were significantly lower in the persuasion condition than the consensus condition, means (sd) for *Accept* were 0.0034 (.010) and 0.0251 (.021), respectively (*W*=1812*, p*=.001, *r*=.644); for *Accommodate+PQ* they were 0.0203 (SD=0.026) and 0.0432 (SD=0.046), respectively (*W* =2523*, p*=.001, *r*=.333); for *Advance* they were 0.0012 (.006) and 0.0089 (.017), respectively (*W*=2327*, p*=.001, *r*=.341); and for *Recap* they were 0.0087 (.027) and 0.0306 (.021), respectively (*W*=1941*, p*=.001, *r*=.412). Between-group differences for the remaining moves were non-significant (see Table 1).

[Insert Table 1 about here]

Analysis of conversational exchanges. The length of argumentative exchanges was calculated and the means for each condition compared. The mean (SD) for the persuasion condition was 2.56 (1.05) and the mean for the consensus condition 3.4 (1.22). The *Students' t-test* yielded significant differences, *t(96)*=-3.67, *p*=.001, effect size *d*=.738.

Analysis of Meta-Talk (Post-Hoc). Given that the means for meta-talk were exceptionally high and between-group differences were significant, we performed post-hoc tests to analyze between-group differences in subcategories of *Meta*. In the interest of reducing the likelihood of Type I error, we limited analyses to meta-moves with means above .008 (i.e., in the top 40th percentile). The resulting moves were productive (+) or counterproductive talk (-) for *Goal Setting (Meta-G GS), Goal*

Checking (Meta-G GC), Goal Met (Meta-G GM) and Managing Stalls (Meta-P ST). Thus, 8 between-group comparisons of means were made in all. After correcting for Bonferroni (p <.05/8=.0062.), all tests for counterproductive talk (-) yielded significant between-group differences except in the case of Meta-P ST-. Means for *Meta-G GC*- were 0.0116 (.021) and 0.0014 (.006) for the persuasive and consensus conditions, respectively, W=2052, p=.006, r=.113. Means for *Meta-G GC*- were 0.0044 (.012) and 0.0002 (.001) for the persuasive and consensus conditions, respectively, W=2234, p=.006, r=.240. Means for the *Meta-G GM*- were 0.0109 (.022) and 0.0005 (.003) for the persuasive and consensus conditions, respectively, W=2115, p=.001, r=.314. In addition, significant differences were found in the means (sd) for *Meta-P ST+. These were* 0.0142 (.026) and 0.0015 (.005) for the persuasion and consensus conditions, respectively, W=2128, p=.003, r=.217. Differences in the rest of the means for productive talk moves and for *Meta-PST*- were non-significant across conditions (see Table 2).

[Insert Table 2 about here]

Analysis of dialogue. Here we present two typical exchanges that illustrate the discourse patterns in each of the two conditions. In the first excerpt (Table 3), we see two students from the persuasion condition arguing about nuclear and thermal (i.e., petroleum-based) power. Alex and Jesse both make claims about the relative strengths or weaknesses of the options (lines 1, 4, 5, and 13), but they spend relatively little time talking about each of these claims. Instead, each speaker competes for "airtime" by interrupting the partner (lines 6-7, 10-11) and advancing claims that do not address the partner's previous utterance (lines 1, 4, and 7). In the one case where Alex invites Jesse to justify the claim that nuclear power stations generate more energy (line 2), Alex ignores Jesse's answer and simply moves on to a different point (line 4). Spending relatively little time on each claim, or simply denying the truth of these claims (lines 5 and 14), offered little opportunity for these students to make sense of alternative claims or integrate knowledge with their positions on the topic. .

[Insert Table 3 about here]

The second excerpt (Table 4) is taken from the consensus condition where the two students discuss their views on biodiesels. Chris was in favor of using biodiesels while Pat is against them. In line 1, Pat introduces the critique that biodiesels can lead to the exploitation of poorer, biomass-producing countries, but proposes a way to address this critique, as well. .Chris accepts this proposal and extends it by introducing ways in which to balance the power dynamic (line 2). This solution leads both students to recognize ways in which laws can be used as incentives for energy efficiency.

[Insert Table 4 about here]

In the end, Pat agrees to adopt Chris' position, but does so in a way that has allowed each speaker to consider the other's arguments. Because the two felt free to take up and build upon one another's ideas, they have the opportunity to make sense of opposing-side claims and integrate knowledge from both sides of the issue. The search for consensus has created opportunities for the co-construction of knowledge.

DISCUSSION

As our analyses indicate, students in the two conditions engaged in different kinds of discourse along several dimensions. Students in the persuasion condition engaged in shorter exchanges around each claim, produced more unjustified critiques (Counter-UC), and were more likely to engage in counterproductive meta-conversation with peers (Meta-). When engaged in meta-conversation, they were more likely to assert that they had no intention of being persuaded (Meta-G GS-), to disingenuously announce that they had persuaded their partner when they hadn't (Meta-G GM-), and to note that they had nothing more to say (Meta-P ST+). In contrast, students in the consensus

condition engaged in longer exchanges around each claim, to extend their partners' claims with additional argument (Advance), and to adapt their own arguments in response to valid critiques from their partners (Accommodate-PQ), to summarize major points made in the dialogue (Recap), and to assent to these recaps and accommodations (Accept). There were also several discourse moves with relatively high means in both groups that did not show significant between group differences. Most notably, students in both conditions produced relatively high and comparable proportions of claims to justify their positions (Argument, Counter-A) and counterarguments and rebuttals (Counter-C and Rebut) to challenge each other's claims.

Taken together the data support the view that students pursued the argumentative goals assigned to them in each condition. Students in both groups exchanged claims in support of their opinions and critiqued those claims, as would be expected in both persuasive and deliberation dialogue (Walton & Krabbe, 1995), but their discourse differed in areas that one might expect, as well. Whereas students in the persuasion condition spent more time entreating their partners to change sides and resisting the open exchange of ideas, students in the consensus condition spent more time elaborating each other's ideas and working out ways to integrate opposing views.

So what do these data tell us about the potential for each discourse type to promote knowledge construction and integration? The results suggest that the competitive discourse goals of the persuasion condition elicited discourse moves that constrained and, in some cases, shut down the exchange of ideas in students' dialogues. Shorter conversational exchanges, the use of unjustified critiques ("my plan is better!") and more frequent stalls in conversation ("I don't know what else to say") signal a limited investigation of ideas and breakdowns in dialogue about arguments. Explicit refusals to be persuaded and false claims to having won the debate also indicate an obstinacy unconducive to the thoughtful exchange and examination of arguments. In short, while students in the persuasion condition posed arguments to one another in equal measure to their peers in the

consensus condition, the competitive goals of the condition led students to spend less time responding to their partner's claims and offered them a limited range of responses to those claims (primarily counterarguments and rebuttals). These constraints in the time and effort spent on processing each other's arguments certainly help explain the lower student outcomes in learning and reasoning in this group that were reported in our previous study (Felton, et al., 2009).

In contrast, the data suggest that the collaborative goals of the consensus condition produced more opportunities for the co-construction and integration of knowledge. Students in this condition engaged in longer conversational exchanges and made use of a wider palette of responses to opposing arguments. They extended their partners' thinking, recapped key ideas and adapted their arguments to accommodate valid critiques. In trying to accommodate their partners' critiques and offering qualifications to their position, students integrated opposing views and refined their thinking. But these conversational moves, though consensus-driven, were not shallow attempts at compromise, which themselves can be a barrier to learning (Damsa, Ludvigsen & Andriessen, 2013; Mercer, 2000). Students in this condition did not start by agreeing with each other and were just as likely as their peers in the persuasion condition to advance opposing arguments and critically examine ideas. However, in this case, critical dialogue became the springboard for the integration of arguments. In essence, students in the consensus condition pursued three norms that facilitated open dialogue and deeper processing of the content:

1. A commitment to invite and understand opposing arguments
2. A commitment to critically examine the reasons and evidence supporting all arguments
3. A commitment to resolve and reconcile conflicting claims and evidence where possible

Pursuing mutually exclusive outcomes, students in the persuasion condition found themselves in conflict with one other and frustrated in their attempts to control the direction and outcome of

dialogue. As a result, they were more resistant to understanding alternative views, less committed to validating legitimate critiques of their own views and less inclined to reconcile conflicting claims in any way other than to rebut them. Because students in the consensus condition had a full range of responses to opposing arguments open to them, from qualifying their original arguments, to adapting their arguments to accommodate valid critiques, to the accepting opposing-side arguments and changing position, they were more likely to make use of the content advanced by a partner in ways that promoted learning.

Of course, this study was based on the dialogues of young adolescents and may not apply to older, more expert, arguers. More advanced arguers may be more adept at navigating the cognitive and social conflict evoked by persuasion goals and may also appreciate the value of integrating conflicting claims and evidence to be more persuasive. As a result, they may not demonstrate the same differential effects of discourse goals on learning and reasoning we've seen here with adolescents or elsewhere with young adults (Crowell, Felton & Liu, 2014; Nussbaum & Kardash, 2008). In addition, these data were collected in peer dyads where students did not benefit from the interventions and guidance of a teacher, who could help guide thinking, mediate conflict and keep talk productive (Forman, Larreamendy-Joerns, Stein & Brown, 1998; Mercer & Littleton, 2007; Yackel, 2002), but this was the very point of our study. We wanted to see what kinds of argumentative dialogue students at this age group would default to when given persuasive and consensus goals. Certainly teachers can influence the course and conduct of dialogue if there to intervene, but such intervention must operate in concert with students' own goals and intentions while arguing. Furthermore, we believe that it is telling that students so clearly fell into distinct kinds of discourse patterns with nothing more than a simple manipulation in instructions. Without any specific training in the features of persuasive and deliberation dialogue, they naturally produced each, indicating that by early adolescence students are capable of adjusting argumentative discourse to fit their purposes.

As a communicative tool, language does more than express thought, it shapes thought as well (Cazden, 2001; Wells, 1999; Wertsch, 1991). When we engage in argumentative discourse, we contrast competing perspectives, question and challenge claims, and build a stronger foundation in support of our views (Kuhn, 2005). However, depending on our intentions, we may also argue to invite new ideas or to probe, explore, and elaborate each other's thinking. Together, these communicative acts offer rich opportunities to go beyond our present understanding, allowing us to examine, refine, and even revise our thinking. These aims foster the educational potential of argument to support knowledge construction (Leitão, 2000) and conceptual change (Dole & Sinatra, 1998). But we need fertile ground for this kind of generative discourse to occur and the social context for the arguments in which we engage must facilitate the open exchange of ideas and motivate a genuine search for a richer, deeper and more nuanced understanding of the world. In the short run, contextual factors like argumentative discourse goals may drive the impact of social context on learning and reasoning, as we have seen in the present study. With prolonged exposure to collaborative argument over the time, however, these contextual factors may have an even greater cumulative effect—positive or negative—on the skills and dispositions that we develop for leveraging talk to engage in collective reasoning (Driver, Newton & Osborne, 2000; Kuhn, Wang & Li, 2010; Lemke, 1990; Michaels, O'Connor & Resnick, 2008). Ultimately, successful collaborative experiences in argumentative discourse may make us more inclined to see discourse as a useful context for extending our thinking, challenging our perspective and exploring new ideas.

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Table 1. Means and standard deviations for discourse moves with tests of significance

Discourse moves	Condition	Mean	SD	Statistics	Higher Mean	Effect Size
Clarify?	Persuasion	0.0131	0.015	*W*= 2406		
	Consensus	0.0121	0.015	*ns*		
Justify?	Persuasion	0.0133	0.020	*W*= 2913		
	Consensus	0.0140	0.020	*ns*		
Position?	Persuasion	0.0051	0.011	*W*=231		
	Consensus	0.0100	0.012	*ns*		
Stance?	Persuasion	0.0144	0.021	*W*=2942		
	Consensus	0.0149	0.021	ns		
Accept	Persuasion	0.0034	0.010	*W*=1812		
	Consensus	0.0251	0.021	p=.001*	Consensus	r=.644
Accomodate+PQ	Persuasion	1.2632	1.575	W=2523		
	Consensus	2.8333	2.823	*p*= .001*	Consensus	r=-.333
Advance	Persuasion	0.0012	0.006	*W*=2327		
	Consensus	0.0090	0.017	p=.001*	Consensus	r=.341
Agree	Persuasion	0.0035	0.007	*W*=2337		
	Consensus	0.0976	0.013	ns		
Add-	Persuasion	0.0037	0.009	*W*=2709		
	Consensus	0.0112	0.021	*ns*		
Anticipate	Persuasion	0.0178	0.030	*W*=2812		
	Consensus	0.0223	0.027	*ns*		
Argument	Persuasion	0.1362	0.086	*W*=2712		

	Consensus	0.1594	0.080	*ns*		
Clarify	Persuasion	0.0138	0.016	*W*=2892		
	Consensus	0.0146	0.017	*ns*		
Concede	Persuasion	0.0273	0.023	*W*=2744		
	Consensus	0.0347	0.029	*ns*		
Continue	Persuasion	0.0394	0.036	*W*=2331		
	Consensus	0.0321	,0269	*ns*		
CA	Persuasion	0.0524	0.035	*W*=2818		
	Consensus	0.0594	0.043	*ns*		
CC	Persuasion	0.0524	0.035	*W*=2772		
	Consensus	0.0594	0.043	*ns*		
Counter-UC	Persuasion	0.0504	0.039	*W*=1552		
	Consensus	0.0155	0.019	p=.001*	Persuasion	r=.492
Disagree	Persuasion	0.0494	0.052	*W*=1851		
	Consensus	0.0232	0.029	p=.006		
Dismiss	Persuasion	0.0147	0.017	*W*=2244		
	Consensus	0.0111	0.017	ns		
Meta	Persuasion	0.1497	0.077	*t* (96)=4.2		
	Consensus	0.0863	.070	p=.001*	Persuasion	d=.9.69
Rebut	Persuasion	0.0293	0.038	*W*=2447		
	Consensus	0.0244	0.027	*ns*		
Recap	Persuasion	0.0087	0.027	*W*=1941.5		
	Consensus	0.0306	0.021	p=.001*	Consensus	r=.412

Table 2. Means and standard deviations for meta-conversational moves with tests of significance

Meta-conversational move	Condition	Mean	SD	Statistics	Higher Mean	Effect Size
GGS+	Persuasion	0.0045	0.013	*W*=2694		
	Consensus	0.0078	0.012	*ns*		
GGS-	Persuasion	0.0116	0.021	W=2052		
	Consensus	0.0014	0.006	*p*=.006	Persuasion	r=.113
GGC+	Persuasion	0.0165	0.033	W=2888		
	Consensus	0.0120	0.017	*ns*		
GGC-	Persuasion	0.0044	0.012	W=2234		
	Consensus	0.0002	0.001	*p*=.006	Persuasion	r=.240
GGM+	Persuasion	0.0141	0.021	W=2304		
	Consensus	0.0083	0.013	*ns*		
GGM-	Persuasion	0.0109	0.022	W=2115		
	Consensus	0.0005	0.003	*p=.001*	Persuasion	r=.314
PST+	Persuasion	0.0142	0.026	W=2128		
	Consensus	0.0015	0.005	*.003*	Persuasion	*r*= .321
PST-	Persuasion	0.0059	0.015	W=2304		
	Consensus	0.0011	0.003	*ns*		

Table 3. Sample coded dialogue from persuasion condition

Speaker	Dialogue	Discourse Move(s)
Jesse	Nuclear power plants generate more energy.	Counter-A
Alex	Why?	Justify-?
Jesse	Because the atoms generate more energy than your coal.	Justify
Alex	But there is danger of the radioactivity.	Counter-A
Jesse	It's not that dangerous. / Besides, think about climate change. That's really damaging.	Dismiss / Counter-A
Alex	Look, the thermal power plant is better...	Counter-UC
Jesse	No, nuclear power plants don´t cause the greenhouse effect.	Counter-A
Alex	So what?	Clarify-?
Jesse	So then we could die.	Clarify
Alex	No. / What are you talking about? Look, I will explain you again, this is the third time: this is Spain…	Disagree / Meta-R CL-
Jesse	I don't care where Spain is!	Dismiss
Alex	Well, you haven't convinced me.	Meta-G GC-
Jesse	What? And what happens when the thermal power plant causes acid rain, then what?	Counter-A
Alex	It doesn't cause acid rain.	Disagree
Jesse	Yes, it does.	Disagree
Alex	No.	Disagree

Table 4. Sample coded dialogue from consensus condition

Speaker	Dialogue	Discourse Move(s)
Pat	Like I said, you need a large amount of land and that means that South America and Africa would be left without land to grow their own food. They need to eat, too. / Plus, it'll also destroy a lot of forests and their ecosystems. / Anyway, I say we use biofuels, and grow biomass, but we make sure we leave enough land for producing countries to grow their own food.	Counter-C / Argument / Accommodate
Chris	That's a good suggestion. / Look, what I would do is pass a law to make sure biofuels are introduced gradually and become the energy of the future. What I would try to do is have each country keep some land for growing and work hard to grow their own biomass. If a country needs more biomass, other countries could sell them their extra or even exchange it for food.	Accept / Advance
Pat	Good idea. / If one country has to buy biomass from another country, the government of that country will try not to consume so much biofuel because buying it outside would be too expensive.	Accept / Advance
Chris	Right, / so they wouldn't be interested in buying biomass from other countries. The government would try to use only the biomass produced in their own country.	Agree / Add
Pat	And maybe that's the key to getting people to adopt other renewable energies like solar.	Advance