TechTrends
DOI 10.1007/s11528-016-0133-5

ORIGINAL PAPER

The Effects of Prior Beliefs on Student Interactions in Online Debates

Allan Jeong[1] · **Zhichun Liu**[1]

Abstract Because prior beliefs can affect how people argue and respond to controversial claims, in this study we examined how patterns in students' responses posted in online debates were associated with students' initial positions on given claims prior to debate. Students that held initial opposing positions to the claim exhibited the tendency to respond to challenges from the opposition with explanations and to respond to explanations from the opposition with challenges. This response pattern was not observed among students with initial supporting and neutral positions. These findings suggest that manipulating group composition based on prior beliefs and manipulating the direction and phrasing of the claim under debate may help to elicit more frequent exchange of opposing viewpoints and raise the level of critical discourse.

Keywords Online discussions · Interaction analysis · Critical thinking

Introduction

Collaborative argumentation is an instructional activity for fostering critical discussions in both face-to-face and online environments (Johnson and Johnson 1992). Argumentation involves the process of building arguments to support a position, considering and weighing evidence and counter-evidence, and testing out uncertainties to extract meaning, achieve understanding, and examine complex ill-structured problems and issues (McAlister 2003). This process not only plays a key role in increasing students' understanding but also in improving group decision-making. Online discussion boards are being increasingly used to engage learners in dialogue in order to promote more in-depth discussions (Baker 1999). However, studies show that the level and quality of online discussions are often limited and shallow (Guzdial 1997; Hewitt 2005).

Given that argumentation is a highly cognitive form of activity, there are particular fallacies and biases in students' reasoning processes that can inhibit the quality of argumentation in online discussions and/or debates. For example, prior research (Tversky and Kahneman 1974; Nickerson 1998; Correia 2011) has documented how people's prior viewpoints can bias how they process and respond to claims on controversial issues. The more people are strongly opposed to a particular claim or issue, the more likely they are to challenge and/or dismiss the arguments presented by the opposition. In contrast, people who have less emotional connection or place lesser importance on the claim under debate are more likely to engage in balanced and more sustained discussion and argumentation to examine and test the veracity of a given claim.

The dialogic theory of language (Bakhtin 1981; Koschmann 1996) provides the rationale and a framework for formulating research questions and methods to study how prior viewpoints affect messages-response sequences (particularly sequences revolving around confrontational exchanges) in online debates. The underlying assumption is that meaning is negotiated and socially constructed as a result of conflict produced in social exchanges, and that conflict is the primary force that drives critical inquiry. Another assumption

✉ Allan Jeong
ajeong@fsu.edu

Zhichun Liu
zl14@my.fsu.edu

[1] Instructional Systems & Learning Technology Program, Florida State University, Tallahassee, FL, USA

Published online: 19 November 2016

is that conflict is produced not by utterances in isolation, but by the relationships between utterances. Extensive research on collaborative learning has shown that conflict and the consideration of both sides of an issue are what drive individuals to articulate their viewpoints, underlying assumptions, explanations, and justifications in order to achieve deeper understanding (Johnson and Johnson 1992; Wiley and Voss 1999). In other words, the need to explain, justify, and understand is felt and acted upon only when conflicts or errors are brought to attention (Baker 1999).

The purpose of this study was to examine how students' initial positions on particular claims under debate respond to the arguments, challenges, explanations, and supporting evidence presented by students on the opposing position in online debates hosted in asynchronous threaded discussion boards. Given the prior research and findings, this study hypothesized that students that are initially opposed to the claim under debate will question/challenge the postings from the opposition at a higher than expected frequency, but not so much the case for students with initial supporting and neutral positions on the claim. As a result, the questions examined in this study were:

1. What patterns exist in the way students respond to postings from the opposing team when a student possesses an initial opposing position, supporting position, and neutral position on the claim under debate?
2. What differences exist in response patterns between these three groups of students?

Method

The participants were 15 graduate students (7 male, 8 female) in an online course on distance learning at a large southeastern university. Each student participated in four online debates hosted in Blackboard discussion forums. Students were divided into supporting and opposing teams (balanced by gender and level of participation in discussions in previous weeks) to debate for or against a given claim. Students were required to insert a tag into the heading of each posting to identify the posting as a supporting or opposing argument (+ARG /–ARG), a challenge (+BUT/-BUT), explanation (+EXPL/-EXPL), and supporting or counter evidence (+EVID/-EVID) with + and – tags to identify team membership (Table 1). Excerpts of student's postings in the debate are presented in Fig. 1. At the end of each debate, students completed an online post-debate survey that asked students to report their initial position on the claim and how their position changed (if any) following the debate. Based on survey responses, each student was identified by initial position (o = opposing, s = supporting, n = neutral).

The message tags were modified to identify type of posting and initial position (i.e., BUTo = challenge posted by student with initial opposing position, EXPLs = explanation/justification posted by student with initial supporting position). The Discussion Analysis Tool (Jeong 2005) was used to tally the number of times each type of message posted by one particular group of students (opposing, supporting, neutral) was posted in reply to another given type of message (posted by students across all groups) to generate the frequency and transitional probability matrices below. In Fig. 2, the

Table 1 Example instructions on labeling messages the online debates

Label	Description of label	Example message by label
+	Identifies a message posted by a student assigned to the team supporting the given claim/statement	–
–	Identifies a message posted by a student assigned to the team opposing the given claim/statement	–
ARG#	Identifies a message that presents one and only one arguments or reason for using or not using chats instead of threaded discussion forums). Number each posted argument by counting the number of arguments already presented by your team. Sub-arguments need not be numbered. ARG = "argument".	-ARG#1 One's choice of media makes very little difference in students' learning because the primary factor that determines level of learning in one's choice of instructional method.
EXPL	Identifies a reply/message that provide additional support, explanation, clarification, elaboration of an argument or challenge.	-EXPL As a result, media are merely vehicles that deliver instruction but do not influence students achievements any more than the truck that delivers our groceries causes changes in our nutrition.
BUT	Identifies a reply/message that questions or challenges the merits, logic, relevancy, validity, accuracy or plausibility of a presented arguments (ARG) or challenge BUT).	-BUT However, one's choice of media can affect or determine which instructional methods are or are not used. If that is the case, then choice of media can make a significant difference.
EVID	Identifies a reply/message proof or evidence to establish the validity of an argument or challenge.	-EVID Media studies, regardless of the media employed, tend to result in "no significant different" conclusions (Mielke, 1968).

Fig. 1 Excerpts of students' postings with student-assigned message labels

Category	Message text
-ARG	Borje Holmberg's Theory of Interaction and Communication states that "learning pleasure supports student motivation" and "strong student motivation facilitates learning"(Simonson, p. 43). I would argue that compelling media and multi-media increases learning pleasure and thus facilitates student learning – Bob
+BUT	Bob, what research is available to support your statement "compelling media and multi-media increases learning pleasure and thus facilitates student learning"?
+EVID	"Extensive research findings indicate that no direct link has been established between delivery medium, level of interaction, and the effect of both on student achievement." Keast 1997. "...Kozma (1994) agrees with me that there is no compelling evidence in the past 70 years of published and unpublished research that media cause learning increases under any conditions. Like all other researchers who have made a careful study of the arguments and research studies (e.g., Winn, 1990), he reaches a conclusion that is compatible with my claims (Clark, 1983)."
-BUT	From my perspective, Clarke's "Media Will Never Influence Learning" does not take into account the effect poor media has on learning. I have attended many a training session where the media was deplorable to say the least. While the content was there, I did not learn very much (if anything) because I was fighting the quality of the media. I would argue that if poor media can have detrimental effect, then good media can have positive effect on learning – Bob
-EXPL	Please refer to a report by Harold F. O'Neil, Univ. of Southern California, for the Office of Naval Research entitled "What Works in Distance Learning" Feb 23, 2003. The report offers a guideline (p. 37) for a multimedia strategy. I quote "People learn better from corresponding words and graphics (e.g., animation, video, illustrations, pictures) than from words alone". This report guideline is based on research conducted by R. E. Mayer and R. B. Anderson and published in the Journal of Educational Psychology 83, 484-490 and 84, 444-452. I would argue that more recent research is showing that multimedia contributes to learning. Thanks, Bob.
-EVID	Bob's -ARG5 talks to the research of Hilary Perraton in that multimedia provide more "effective" learning experiences. The pleasurability of the experience does support the effectiveness of the learning.

Note: ARG = argument, BUT = challenge, EVID = supporting evidence, EXPL = explanation

frequency matrix (under opposing position) shows that challenges (BUT) elicited a total of 8 explanations from students that possessed an initial position in opposition to the debated claim (EXPLo), or 19 % of all responses posted in reply to the challenges. This was significantly higher than the expected frequency based on the z-score of +2.26 at $p < .05$. In contrast, only 5 and 2 % of the responses to challenges (BUT) were from students with supporting and neutral positions, respectively – in which neither of these observed frequencies were significantly higher than expected frequencies at $p < .05$. Altogether, these response probabilities were graphically conveyed using transitional state diagrams.

Main findings

A comparison of the three state diagrams (Fig. 3) reveals that students with initial opposing positions to the claims

Opposing position

Frequency matrix

	ARG	BUTo	EXPLo	EVIDo	Replies	No Reply	Givens
ARG	0	12	12	12	139	7	49
BUT	0	10	8	2	42	55	75
EXPL	0	8	1	3	23	20	36
EVID	0	5	1	3	22	26	40
	0	35	22	20	226	168	303

Transitional probability matrix

	ARG	BUTo	EXPLo	EVIDo	Replies	No Reply	Givens
ARG	.00	.09	.09	.09	139	7	49
BUT	.00	.24	.19	.05	42	55	75
EXPL	.00	.35	.04	.13	23	20	36
EVID	.00	.23	.05	.14	22	26	40
	0	35	22	20	226	168	303

Z-score matrix

	ARG	BUTo	EXPLo	EVIDo	
ARG	-0.01	-3.60	-0.71	-0.14	139
BUT	0.00	1.65	2.26	-1.03	42
EXPL	0.00	2.70	-0.92	0.75	23
EVID	0.00	0.99	-0.86	0.83	22
	0	35	22	20	226

Supporting position

Frequency matrix

	ARGs	BUTs	EXPLs	EVIDs	Replies	No Reply
ARG	0	19	10	9	139	10
BUT	0	4	2	1	42	58
EXPL	0	3	0	0	23	28
EVID	0	1	1	1	22	32
	0	27	13	11	226	168

Transitional probability matrix

	ARGs	BUTs	EXPLs	EVIDs	Replies	No Reply
ARG	.00	.14	.07	.06	139	10
BUT	.00	.10	.05	.02	42	58
EXPL	.00	.13	.00	.00	23	28
EVID	.00	.05	.05	.05	22	32
	0	27	13	11	226	168

Z-score matrix

	ARGs	BUTs	EXPLs	EVIDs	
ARG	-0.01	1.01	1.18	1.42	139
BUT	0.00	-0.54	-3.31	-0.83	42
EXPL	0.00	0.17	-1.25	-1.14	23
EVID	0.00	-1.13	-0.26	-0.07	22
	0	27	13	11	226

Neutral position

Frequency matrix

	ARGn	BUTn	EXPLn	EVIDn	Replies	No Reply
ARG	0	13	13	11	139	8
BUT	0	5	1	0	42	59
EXPL	0	1	0	1	23	33
EVID	0	4	0	1	22	35
	0	23	14	13	226	168

Transitional probability matrix

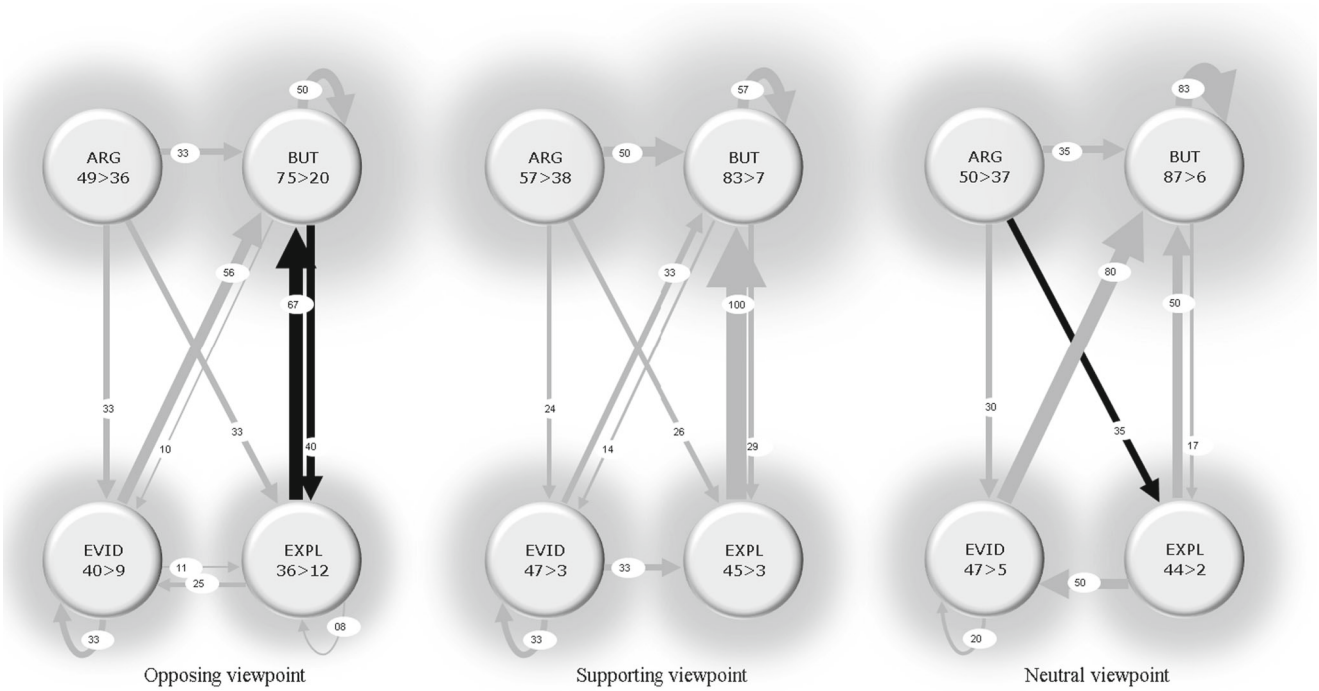
	ARGn	BUTn	EXPLn	EVIDn	Replies	No Reply
ARG	.00	.09	.09	.08	139	8
BUT	.00	.12	.02	.00	42	59
EXPL	.00	.04	.00	.04	23	33
EVID	.00	.18	.00	.05	22	35
	1E-04	23	14	13	226	168

Z-score matrix

	ARGn	BUTn	EXPLn	EVIDn	
ARG	-0.01	-0.52	2.49	1.76	139
BUT	0.00	0.41	-1.14	-1.77	42
EXPL	0.00	-0.98	-1.30	-0.31	23
EVID	0.00	1.31	-1.27	-0.26	22
	0	23	14	13	226

Fig. 2 Screenshot of frequency, transitional probability, and z-score matrices in DAT software

revealed the tendency to respond to challenges from the opposition with explanation (BUT→EXPL). In contrast, this message-response "pattern" was not exhibited by students holding initial supporting and neutral positions. To determine if this observed difference in response pattern was statistically significant, the Yule's Q-test was used to compute a phi-coefficient (ø) to measure the strength of association between group membership and particular



Note: Thickness of arrow conveys strength of transitional probability; dark black arrows identify probabilities significantly greater than expected based on *z*-score tests ($p < .01$) performed in the DAT software; first and second numerical value displayed in nodes identify the number of times the given action was performed and the number of events that followed the given action; the size of the glow emanating from each node conveys the number of times the action was performed.

Fig. 3 Transitional state diagrams depicting the response probabilities produced by each group

pattern (zero indicating no association, .90 an above indicating extremely strong relationship, .70 to .89 indicating a strong relationship, .50 to 69 a moderate relationship, .30 to .49 a low relationship, and .30 and below a weak relationship). The 40 % vs. 29 % of responses to challenges with explanations produced by students with initial opposing vs. supporting positions, respectively, revealed a low association with initial position ($ø = 0.333$; $SE = 0.415$). However, the 40 % vs. 17 % of responses to challenges with explanations produced by students with initial opposing vs. *neutral* positions, respectively, revealed a *moderate* association with initial position ($ø = 0.538$; $SE = 0.421$). These findings suggests that students holding neutral positions in particular may need specific instructions and encouragement to respond to challenges with explanations to defend and build on their arguments.

The state diagrams also reveal that students with opposing positions to the claims exhibited the tendency to challenge explanations from the opposition (EXPL→BUT) – a response pattern that was not exhibited by students holding initial supporting and neutral positions. Although the 67 % vs. 100 % of responses to explanations with challenges were produced by students with initial opposing vs. supporting positions, respectively, the Yule's Q test could not be used to test the significance of this observed difference due to low cell frequency and because the cell frequencies in the number of responses to explanations (other than challenges) were zero among the students holding supporting positions. The 67 % vs. 50 % of responses to explanations with challenges produced by students with opposing vs. neutral positions, respectively, revealed a weak association between the EXPL→BUT response pattern and initial position ($ø = 0.333$; $SE = 0.566$). These findings overall provide both mixed and weak evidence to indicate the need to use specific interventions that encourage students with supporting and neutral position to challenge explanations presented by the opposition.

In addition, students with neutral positions showed the tendency to reply to arguments posted by members on the same side with explanations to strengthen their team's position. This pattern was not exhibited by the students holding initial opposing and supporting positions. The 35 % vs. 33 % of responses to arguments with explanations produced by students with neutral vs. opposing positions, respectively, revealed no association with initial position ($ø = 0.04$; $SE = 0.246$). The 35 % vs. 26 % of responses to arguments with explanations produced by students with neutral vs. supporting positions, respectively, revealed a weak association with initial position ($ø = 0.205$; $SE = 0.241$). This observed response pattern suggests that balancing debate teams with equal number of students holding neutral positions can help to ensure that arguments on both sides of the debate are evenly sufficiently grounded and explained, but that the overall impact may be minimal.

Conclusions

Overall, the findings to a certain extent are consistent with prior research (Tversky and Kahneman 1974; Nickerson 1998; Correia 2011) that find that people whom are strongly opposed to a particular claim are more likely to challenge the arguments and claims presented by the opposition. Although the results of this study are based on a relatively small sample and hence may not be generalizable, the findings in this study provide insights into precisely how prior beliefs can affect the quality of argumentation in online discussions/debates. These findings suggest that the depth of argumentation can potentially be increased by controlling group composition based on students' prior beliefs. In other words, the findings suggest online instructors can increase the depth of argumentation by surveying students on their prior beliefs prior to discussion, and assign students to teams to either support or oppose a given claim based on the students' prior beliefs. Another strategy online instructors can use is to phrase the debated claim in two ways (or inversely) so that it is presented from an oppositional standpoint for the teams on both sides of the debate. These steps may help to promote more responses that challenge presented arguments and more rebuttals to challenges with explanations/justifications. However, future studies will be necessary to test the effects of these two and other possible interventions using controlled experimental design, conducted across discussions with multiple cohorts/groups to increase the sample size and to control for idiosyncratic differences in the social dynamics within groups, and applying a more conservative *p*-value for identifying patterns in the message-response sequences produced by different interventions.

References

Baker, M. (1999). Argumentation and constructive interaction. In P. Courier & J. E. B. Andriessen (Eds.), *Foundations of argumentative text processing* (pp. 179–202). Amsterdam: Amsterdam University Press.

Bakhtin, M. (1981). Dialogic imagination. In M. Holquist (Ed.), *Trans. Caryl Emerson and Michael Holquist*. Austin: University of Texas Press.

Correia, V. (2011). Biases and fallacies: the role of motivated irrationality in fallacious reasoning. *Journal of Reasoning and Argumentation, 3*(1), 107–127.

Guzdial, M. (1997). Information ecology of collaborations in educational settings: Influence of tool. In R. Hall, N. Miyake, & N. Enyedy (Eds.), *Proceedings of computer-supported collaborative learning* (pp. 83–90). Toronto: Lawrence Erlbaum Associates.

Hewitt, J. (2005). Toward an understanding of how threads die in asynchronous computer conferences. *Journal of the Learning Sciences, 14*(4), 567–589.

Jeong, A. (2005). *Discussion analysis tool (DAT)*. Retrieved at http://myweb.fsu.edu/ajeong/dat.

Johnson, D., & Johnson, R. (1992). *Creative controversy: Intellectual challenge in the classroom*. Edina: Interaction Book company.

Koschmann, T. (1996). Paradigm shifts and instructional technology. In T. Koschmann (Ed.), *CSCL: theory and practice of an emerging paradigm* (pp. 1–23). Mahwah: Lawrence Erlbaum.

McAlister, S. (2003). *Assessing good argumentation*. Retrieved April, 10, 2004, from http://iet.open.ac.uk/pp/s.r.mcalister/personal/AssessingGEA.htm.

Mielke, K. (1968). Questioning the questions of ETV research. *Educational Broadcasting Review, 2*, 6–15

Nickerson, R. S. (1998). Confirmation bias: a ubiquitous phenomenon in many guises. *Review of General Psychology, 2*(2), 175–220.

Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: heuristics and biases. *Science, 185*(4157), 1124–1131.

Wiley, J., & Voss, J. (1999). Constructing arguments from multiple sources: tasks that promote understanding and not just memory for text. *Journal of Educational Psychology, 91*, 301–311.