Goal Instructions in Computer-Supported Collaborative Argumentation: Can You Find a Reason?

E. Michael Nussbaum
Dept. of Educational Psych., University of Nevada, Las Vegas, Box 453003, Las Vegas, NV 89154-3003
Tel: (702) 895-2665, Fax: (702) 895-1658
E-Mail: nussbaum@unlv.nevada.edu

Abstract: This study explored the effect of different types of goal instructions on students' on-line argumentation. Goal instructions specify what students should try to achieve during on-line discussions. General goals (to persuade or explore) were crossed with specific goals (to generate reasons or counterarguments/rebuttals) in a 3 x 3 randomized design using 240 undergraduates. The instruction to generate as many reasons as possible resulted in deeper and more qualified arguments, whereas the "explore" goal had little effect. The persuade goal resulted in arguments that were more focused and adversarial. These results have important implications for building richer on-line discussions. In particular, instructions to generate as many reasons as possible can result in the exploration and integration of opposing sides of an issue, potentially enhancing psychological understanding and best promoting Mercer's (1996) notion of exploratory talk.

Collaborative argumentation refers to students working together to construct and critique arguments (Veerman & Treasure-Jones, 1999). It is similar to Mercer's notion of exploratory talk (1996), which involves students building on one another's ideas, but also disagreeing with another when appropriate to more fully explore an issue. Exploratory talk improves both group and individual problem solving skills (Fernández, Wegerif, Mercer, & Rojas-Drummond, 2001). Although Mercer developed the idea of exploratory talk in the context of face-to-face discussions, with the advent of the Internet and on-line learning, the idea of exploratory talk has been incorporated into notions of computer-supported collaborative argumentation, or CSCA (Veerman & Treasure-Jones, 1999). On-line discussions that reflect deep thinking about various sides of a topic or concept have been have been postulated to result in greater learning and the development of critical thinking skills (Koschmann, 2003).

For exploratory talk to occur in CSCA, however, students must be willing to disagree with one another and take different points of view. Unfortunately, researchers have documented the reluctance of many students to disagree with one another during asynchronous discussions (Koschmann, 2003). An important question, therefore, is how to stimulate exploratory talk and better argumentation in on-line environments. Some researchers have explored various types of complex scaffolds to help students generate arguments and counterarguments (Bell & Linn, 2000; Nussbaum, Hartley, Sinatra, Reynolds, & Bendixen, in press; Sandoval, 2003). Another avenue of research involves the use of simple goal instructions. Goal instructions refer to specifying--as part of a discussion question--what students are expected to accomplish, for example, "persuade one another of your point of view," or "explore this issue in-depth to increase your understanding of it."

Research on Goal Instructions

Several researchers have examined the effect of goal instructions on students' argumentative writing (Page-Voth & Graham, 1999; Nussbaum & Kardash, 2003), and have specifically compared the effect of general goals (such as to persuade) with more specific goals (such as to generate counterarguments and rebuttals, see Ferretti, MacArthur, & Dowdy, 1999). Specific goals specify the type of argumentation moves that students should engage in, and researchers have found that specific goals--because they provide more guidance--are more effective than general goals (Ferretti et al., 1999). In a recent study, Nussbaum and Kardash, 2003, found that a specific goal to generate counterarguments and rebuttals was effective in producing more of these argumentation elements. On the other hand, a specific

goal to produce more reasons did not result in a statistically significant greater number of reasons, although there was a trend in the hypothesized direction. Nussbaum and Kardash postulated that the reason goal was ineffective because it did not provide students with any strategy for generating reasons beyond those they would normally think of.

Another finding, somewhat in contrast with other researchers, was that the general goal "to persuade" did have an effect, but it was to make written essays less likely to explore opposing sides of an issue. This effect presumably occurred because students believe that if they present any sort of counterarguments, it would make their essays less persuasive (Santos & Santos, 1999). Nussbaum and Kardash (2003) concluded that overall, the specific goal to generate counterarguments was more useful than the general goal to persuade.

The Computer-Supported Environment

These findings were explored in the context of writing argumentative essays, but not in an on-line discussion environment. For the purpose of stimulating exploratory talk, however, the use of goal instructions could be easily extended to on-line discussions. It is unclear, though, whether similar results would hold. Both contexts involve students writing arguments, but the arguments in an on-line environment are dialectical in nature (Andriessen, Baker, & Suthers, 2003), meaning that students are responding to one another's contributions. Because a dialectical situation presents students with other people's ideas, these ideas may stimulate new or related ideas in students. A "reasons goal" may therefore be more effective in a dialectical situation because students are better able to think of a greater variety of reasons than when they compose an argumentative essay only by themselves. Likewise, a persuasion goal may cue students to be more one-sided in their thinking (as in the nondialectical context), but in a dialectical context, students may still be exposed to different points of view because "persuasion" might cue students to debate and therefore disagree. Persuasion might, however, still not be as effective as other types of goal instructions in stimulating exploratory talk because it may decrease collaboration.

The purpose of this study was to examine the effect of different types of goal instructions (both general and specific) on the nature of students' on-line argumentation. In addition to the general goal, "to persuade," a general goal "to explore" was also examined because this goal was more aligned to the purpose of exploratory talk. However, because general goals may be less effective than specific goals, specific goals regarding the generation of reasons, counterarguments, and rebuttals (that is, refutation of counterarguments) were also examined. In regards to reasons, although students do often spontaneously generate reasons for their claims, of interest was whether students would generate deeper chains of reasoning by providing reasons (or supporting evidence) for other reasons, or by including a greater variety of reasons in their arguments.

Analytic Framework for Argument

In this study, different type of goal instructions constituted the independent variable, the complexity of arguments the dependent variable. Before proceeding, it is necessary to articulate the analytic framework that was used to conceptualize argumentation. Based on a review of contemporary texts on the analysis of arguments (e.g., Inch & Warnick, 2002; van Eemeren, Grootendorst, & Henkemans, 2003), a conceptual framework for analyzing arguments was developed. In this framework, an argument consists of a series of claims that bear logical relations to one another. This relationship can be either one of support (or being supported by), or opposition, as when one claim refutes another or makes the other claim less likely. Claims are made when individuals interact with one another in the process of engaging in certain social activities, such as having a discussion, engaging in a negotiation, seeking information, etc. (Walton, 1998). Not all statements made during an exchange are considered argumentative claims; the statements must bear a logical relationship to other claims.

In this framework, an argument consists of an initial global claim and a number of subarguments. An initial global claim is the major contention made by the first party to an argument (for example, the position on the issue under discussion of the first person to speak or to post a electronic discussion note). There are four types of subarguments: (a) supporting, (b) opposing, (c) contingent, and (d) divergent. Supporting subarguments make the global claim more likely to be true, opposing subarguments less likely. Contingent subarguments may simultaneously consider both sides of an issue, for example by weighing

advantages against disadvantages, or by holding that the global claim may be true but only under certain conditions. A divergent subargument departs from the original line of discussion by providing support for a major claim different (but not opposing to) the initial global claim.

Claims can be classified along two dimensions: (a) type, and (b) level. A claim's type is determined by the type of subargument it is part of, for example, the claims making up a supporting subargument are considered supporting claims. Likewise, claims making up an opposing subargument are considered opposing claims. (Note that some of the opposing claims support one another, but they are globally considered opposing, not supporting, claims because they do not support the initial global claim.) The level of a claim refers to its place in the local chain of support within a subargument. Level 1 claims are the basic contention of a subargument, Level 2 claims are reasons or evidence supporting Level 1 claims, Level 3 claims are reasons or evidence supporting Level 2 claims, and so on. Tracking level may be important from a psychological perspective because the use of more levels may indicate that students are thinking more deeply about an issue.

It should be noted that this framework incorporates all the elements of the well-known Toulmin model (1958), but includes other features as well that reflect more of the complexities of actual arguments (such as divergence). One differences is that many users of the Toulmin model focus on articulating unexpressed "warrants" or assumptions made by participants, but identifying unexpressed claims is a difficult and somewhat unreliable task (van Eemeren et al., 2002) that may or may not add anything to an analysis. In this study, implicit claims were not analyzed, but it was recognized that sometimes opposition was made to implicit claims.

Hypotheses

We would expect that during an on-line discussion, different types of goal instructions would have effects on different components of argumentation, both type and depth (as measured by number of levels reflected in an argument). These hypotheses are summarized in the following table:

Table 1. Hypotheses of the effect of different goal instructions on subargument type and depth

	General Goal			Specific Goal		
Outcome	Explore	Persuade	None	Reasons	Counter-Args/Reb.	None
Type						
Reasons	I			I		
Opposition	I	I			I	
Contingency	I	D			I	
Divergence	I					
Depth	I	I		I		

Note. I = Increase. D = Decrease.

As noted previously, although the instruction to generate as many reasons as possible was not effective in previous research when students were writing individual essays (Nussbaum & Kardash, 2003), the dialectical context of on-line discussions may stimulate more potential ideas in students. The study therefore tested the hypothesis that in an on-line environment, the total number of reasons would increase as a result of this goal instruction. Because some of these could be reasons for reasons, it was also hypothesized that depth would increase. Instructions to generate counterarguments/rebuttals would likely increase opposition and contingency. Nussbaum and Kardash (2003) found, however, no effect of this goal on depth of counterarguments; students did not tend to elaborate their counterarguments but were still somewhat one-sided in their thinking. This tendency has been termed the "my-side bias" (Perkins, Farady, & Bushey, 1991). Because there is no grounds for why the dialectical context would eliminate this bias, it is again hypothesized that the counterargument goal would have no effect on depth.

In relation to the more general goals (to explore or to persuade), it is unclear whether these goals would have an effect. It could be that the goals are so general that they would have little influence on

students' arguments. On the other hand, if these general goals do have an effect, the "explore" goal would likely affect all argument components, because students would be exploring the problem space in various, multiple ways (as suggested by Mercer's conceptualization of exploratory talk). The latter hypothesis is shown in the table. In respect to the persuade goal, it might specifically increase opposition, because it may cue students to engage in more adversarial discourse, as in a debate. Students might also generate more supporting reasons and evidence to make their arguments more persuasive, thus increasing depth. On the other hand, because contingent arguments might be viewed as less persuasive (as was found by Nussbaum & Kardash, 2003), the persuasion goal might decrease contingency.

Method

Participants consisted of 224 undergraduates enrolled in various sections of an educational psychology course, and participated in order to receive course credit. The majority were female (80%) with a median age of 26.

Participants were randomly assigned to discussion groups of three and used an electronic discussion board (WEB-CT) to discuss the following question related to their educational psychology class: "Does watching television cause children to become more violent?" The researcher posted the question to the electronic bulletin board for each group, along with additional instructions (which varied by goal condition). The additional instructions were:

Explore: "Try to explore this issue in-depth to increase your understanding of it."

Persuade: "Try to persuade others of your point of view."

Reasons: "Provide as many reasons as you can to justify your position, and try to provide evidence that supports your reasons."

Counterarguments/Rebuttals: "Consider reasons why others disagree with you or might disagree with you and why those reasons might be wrong."

A 3 x 3 randomized crossed design was used, with general goal (Explore, Persuade, or None) crossed with specific goal (Reasons, Counterarguments, or None). All participants were first given a 45-minute orientation session on how to use WEB-CT and on the requirements of the study. The students were told that they were to have a conversation about this issue and were required to post at least two notes but could post more. They were given three days to post the first note and an additional two days to post the second. After the first three-day period, the researcher posted a "reminder note" that participants should "respond to one another's notes (post at least two by Saturday)." The reminder note also repeated the goal instructions. Groups where not all three students posted notes, or which contained less than 80% of the requested notes, were eliminated from the analysis, reducing the effective sample size to 180 students.

For coding purposes, each discussion note was scored for both type of argumentation claims made and level of claim (up to three levels were coded). All notes were scored independently by two raters, who then resolved any disagreement through discussion. All scoring was conducted blind to condition.

Results

In analyzing the data, outlying cases with $z > 3.20$ were removed for each outcome variable, as such extreme cases are generally overly influential and bias statistical estimates (Tabachnick & Fidell, 1996). The number of cases (both individuals and groups) for each condition is shown in Table 2.

Table 2. Number of groups (and individuals) by goal condition.

Specific Goal	General Goal		
	Explore	Persuade	None
Reasons	6 (17)	7 (21)	4 (12)
Counterargs./Reb.	8 (26)	7 (21)	6 (24)
None	5 (18)	8 (20)	7 (21)

Because participants operated in small groups, it was necessary to use multilevel modeling. A multilevel approach is needed because the outcomes for individuals were not statistically independent from

the others in their group (which is of course the whole point of engaging in dialectical argumentation). This approach resulted in two levels of analysis: the student level and the group level. MLwiN multilevel statistical software (Rabash et al., 2000) was used to conduct the tests of statistical significance, taking into account both of these levels. Although one could simply use groups as the basic level of analysis, that approaches significantly decreases the number of cases and therefore statistical power. A multilevel approach is therefore preferred.

Because the data consisted of counts that were not normally distributed (the mode in most cases was 0), Rabash et al. (2000) recommend fitting a Poisson distribution to the data. In addition, although there were 60 groups, the size of each group was small (only three). In this situation, Rabash et al. recommend refining parameter estimates using Bayesian modeling for small samples with Monte Carlo simulations. Regression methods (RIGLS) were used to make estimates of all parameters, which were then combined with prior default assumptions about the shape of each parameter's sampling distribution—for example, that it is uniform—to produce a posteriori estimates. Because—in this approach—the estimate of one parameter affects the estimate of others (includes slopes and variances), the process was repeated continually (at least 50,000 times). The parameter estimates from the previous iteration were used as input for the next, but with one parameter at a time allowed to vary randomly. This procedure provided more valid tests of statistical significance. T-tests of the regression slopes were conducted, with the degrees of freedom (n-k-1) based on the number of groups rather than the number of individuals, as that provided a more conservative test.

Although it is usual when using regression to use standardized slope coefficients as estimates of effect sizes, regression coefficients are difficult to interpret when nonlinear models are employed, so in what follows we report effect sizes as mean differences, standardized by the standard deviation of the control group (Cohen's *d*), with significance tests conducted as described above. The means—by condition—are shown in Table 2.

Table 3. Mean number of argument claims (and SDs) for goal conditions

	General Goal			Specific Goal		
Outcome	Explore	Persuade	None	Reasons	Counter-Args/Reb.	None
No. claims	4.44	5.29**	4.51	5.40**	4.48	4.50
	(1.93)	(1.87)	(1.84)	(2.20)	(1.88)	(1.51)
By level:						
Level 1	2.30	2.75**	2.49	2.88**	2.30	2.46
	(0.84)	(0.97)**	(0.97)	(1.02)**	(0.87)	(0.87)
Level 2	1.98	2.30**	1.84	2.28**	1.93[a]	1.98
	(1.20)	(1.24)	(1.15)	(1.37)	(1.10)	(1.16)
Level 3	0.24	0.35*	0.18	0.28*	0.29**	0.19
	(0.56)	(0.69)	(0.43)	(0.57)	(0.62)	(0.52)
By type:						
Supporting	1.56	2.00**	1.49	1.67	1.69	1.70
	(1.42)	(2.10)	(1.48)	(1.98)	(1.58)	(1.60)
Oppositional	1.02	1.46*	0.95	1.28	1.22**	0.91
	(1.57)	(1.65)	(1.33)	(1.50)	(1.66)	(1.39)
Contingent	0.46a	0.63	0.56	1.02*[a]	0.28	0.42
	(1.61)	(1.37)	(1.30)	(2.03)	(0.98)	(1.16)
Divergent	2.40**[a]	1.88	2.09	2.58**	1.81a	2.14
	(2.31)	(1.91)	(1.96)	(2.08)	(2.44)	(1.73)
N	177	178	180	179	177	179

Notes. Significance levels are in relation to the "None Condition." *Ns* differ because of differential removal of outliers for each outcome variable.

[a]Because interactions exists (Explore x Reasons and Explore x Counterargs./Rebuttals), interpret figures with caution. See Table 4.

*$p < .05$. **$p < .01$.

The table indicates significant effects for both the persuade and reasons conditions. Both resulted in significantly more claims than the control conditions ($t(49) = 5.02$, $p < .001$, $d = 0.42$ for "persuade," and $t(49) = 4.27$, $p < .001$, $d = 0.60$ for "reasons"). These are moderately strong effect size, almost a half of a standard deviation. Both conditions also had effects on all three levels of argument, although the effect of "persuade" was somewhat stronger (*d*s were 0.4 at both Levels 2 and 3 for "persuade," but only 0.26 and 0.17 for these respective levels for the reasons condition). When examined by type of claim, "persuade" resulted in both more supporting and opposing claims ($t(49) = 3.37$, $p < .01$, $d = 0.34$ for supporting, $t(49) = 2.68$, $p < .05$, $d = 0.38$ for opposing), but there was no effect on contingent claims. On the other hand, the reason condition did have an effect on contingent claims ($t(49) = 2.49$, $p < .05$), with a fairly strong effect size ($d = 0.52$) and a smaller effect on divergent claims ($t(49) = 2.14$, $p < .05$, $d = 0.25$). Overall, persuasion resulted in more opposition, and reasons resulted in more contingency and divergence.

In regards to the explore condition, only the hypothesized effect on divergence was confirmed. Table 3 indicates an effect on divergence ($t(49) = 3.53$, $p < .001$) but the effect size was small ($d = 0.16$) and complicated by an interaction with the counterargument/rebuttal condition ($t(49) = 2.94$, $p < .01$). Inspection of the cell means (see Table 4) indicate that the positive effect on divergence did not exist when the explore goal was combined with the counterargument goal; presumably, students tended to explore counterarguments rather than ancillary issues. There was also an Explore x Reasons interaction ($t(49) = 2.40$, $p < .05$), indicating that the reason condition did not result in more contingent claims when combined with the explore goal (see Table 4); rather students tended to diverge.

Finally, the counterargument condition did result in more oppositional claims ($t(49) = 3.35$, $p < .01$, $d = 0.22$) and more Level 3 claims ($t(49) = 3.24$, $p < .01$, $d = 0.19$), but in both cases the effects were small.

Table 4. Mean number of argument claims by general x specific goal conditions for contingency and divergence

Contingency				Divergence			
Other goal	Explore	Persuade	None	Other goal	Reason	Counter-Arg./Reb.	None
Reasons	0.77*	1.02	1.47	Explore	3.53	1.48**	2.72
n/*SD*	18/2.55	21/1.61	12/2.73		17/2.40	27/1.89	18/2.37
Total	1.23	0.49	0.63	Total	2.58	1.81	2.14
n/*SD*	51/2.31	72/1.23	57/1.51		50/2.44	72/1.73	57/2.08

*$p < .05$. **$p < .01$.

Discussion

One question examined by this study is what type of goal instructions is most effective in an on-line environment. Of the various instructions examined, it was the reason instruction ("generate as many reasons as possible") and the persuade instruction ("persuade others of your point of view") that had the strongest effects. The effects of the reason instructions in the on-line, dialectical context were also quite different than those found in a more individualistic context (Nussbaum & Kardash, 2003). As was hypothesized, the reason goal was more powerful in the dialectical context where students are exposed to the ideas of other students. This goal increased the total number of reasons generated as well as argument depth. Surprisingly, and of particular importance, this condition also had a fairly strong, positive effect on contingent claims (about one-half standard deviation). Interestingly, when one examines the reason condition uncombined with any general goal, the effect size is more than one standard deviation; both the explore and persuade conditions may dilute the effect of reasons on contingency (although this point must be viewed with caution because the Reason x Persuade interaction was not significant).

Why is it important that the reason goal promotes contingency? Contingency involves examining multiple sides of an issue in the same subargument, or holding that the global claim may be true only under certain conditions. For example, one might hold that watching TV may cause some children to become violent only if parents have not taught them how to self-regulate or distinguish reality from fantasy. Contingent claims contain qualifications which are responses to implicit counterarguments (Toulmin, 1958), in this case that not all children who watch TV become violent. Contingent claims reflect integration of opposing arguments or factors and, for this reason, may be psychologically more valuable in promoting understanding of concepts. Also, from a philosophic perspective, contingent arguments are often stronger than simpler arguments, because the strength of an argument can be viewed as a function of how well if refutes (or at least takes into account) possible objections (Pollock, 1987; Rips, 1998). Finally, contingent claims are a sign of exploratory talk, which is a desirable feature of on-line discourse. The fact that a goal instruction to generate "as many reasons as you can think of" results in deeper and more contingent arguments is therefore of practical importance. It appears to result in more exploratory talk than just the general goal "to explore," as this instruction appears too vague to have an effect other than to encourage students to diverge (and combining the two goals does not appear to be helpful). The reason goal appears to encourage students to specifically explore reasons, including opposing factors, although in the form of contingent rather than opposing claims

In contrast, a persuasion goal--while also resulting in deeper arguments--does result in more oppositional rather than contingent claims. Prior to collecting the study, it was unclear whether a general goal would have such an effect, but it may be that--compared to “explore”--persuasion is less vague and more specific (but not quite as specific as generating reasons). Compared to the reason condition, persuasion also results in less divergence; students stay on the initial question more rather than exploring related issues such as how to reduce the amount of violence on television. Whether divergence is viewed as good or bad depends on the instructor's pedagogical goals. If an instructor wants students to focus only on the initial question for pedagogical reasons (for example, to understand how violence is often caused by social modeling), then divergence should be avoided; on the other hand, if an instructor wants students to explore more broadly, for example to gain practice with formulating and solving problems, or to better connect a topic to their own personal experiences or interests, then divergence might be encouraged, specifically with a reason goal instruction.

The results for the counterargument/rebuttal goal were disappointing. The hypothesis that it would increase contingency was not confirmed; it did increase opposition, but only weakly. This goal instruction was more powerful in the context of writing individual essays (Nussbaum & Kardash, 2003). The goal instruction was lifted verbatim from Nussbaum and Kardash, but it could be that the requirement to generate counterarguments AND rebuttals did not fit the dialectical context well; students may know how to oppose other students’ views, but it may not be natural to then try to rebut one's own opposing view. It may in fact violate implicit rules of dialogic commitment (see Walton, 1998) and may also be too psychologically complex. Future research should perhaps examine omitting the rebuttal instruction and focus more directly only on counterarguments.

In general, though, it was the reason condition that most facilitated exploratory talk and better argumentation. It is encouraging that one can achieve such powerful effects simply by adding a statement to the end of a discussion question. If you ask students to find reasons, they may—when working dialectically as a group--be able to find some good ones and to explore a topic more in-depth. Interestingly, their discourse may also consider opposing ideas and factors, thus overcoming the "my-side" bias found in previous research (Nussbaum & Kardash, 2003). Such in-depth exploration of multiple sides of a topic may enhance students’ understanding and learning.

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