# Supporting Social Deliberative Skills Online: The Effects of Reflective Scaffolding Tools*

Tom Murray[1], Lynn Stephens[1], Beverly Park Woolf[1],
Leah Wing[3], Xiaoxi Xu[1], and Natasha Shrikant[2]

[1] School of Computer Science
[2] Commination Dept.,
[3] Legal Studies Dept.
University of Massachusetts, Amherst, MA
tmurray@cs.umass.edu

**Abstract.** We investigate supporting higher quality deliberations in online contexts by supporting what we call "social deliberative skills," including perspective-taking, meta-dialog, and reflecting on one's biases. We report on an experiment with college students engaged in online dialogues about controversial topics, using discussion forum software with "reflective tools" designed to support social deliberative skills. We find that these have a significant effect as measured by rubrics designed to asses dialogue quaility and social deliberative behaviors.

**Keywords:** E-participation and e-democracy, Empathic online communities, Communication and deliberation skills, scaffolding.

## 1 Introduction

A key human capacity is the ability to negotiate situations involving differing opinions where a resolution of ideas is sought, e.g., in dispute resolution, collaborative problem solving, knowledge building, and civic deliberation processes. The need for this deliberative capacity is seen in all realms of human activity from international politics, to collaborative work, to mundane familial squabbles (Gastil & Black, 2008; Spragens, 1990; Kögler, 1992; Toulmin, 1958). Conflict and difference too often result in unsatisfactory outcomes that can be attributed to insufficient skill, or an inability to bring existing skills to bear in difficult situations. Throughout the various contexts mentioned above many of the same underlying skills and capacities are called for. For example, Jordan et al. (2013) propose two important skill sets for skillfully addressing "complex societal issues, such as gang-related crime, deteriorating residential areas, environmental problems, long-term youth unemployment, [and] racist violence" (p. 34.). These skills are "complexity awareness" and "perspective

* This research was funded by an award from the NSF #0968536, "The Fourth Party: Improving Computer-Mediated Deliberation through Cognitive, Social and Emotional Support." Any opinions, findings, conclusions or recommendations are those of the authors and do not necessarily reflect the views of the funding agency.

A.A. Ozok and P. Zaphiris (Eds.): OCSC/HCII 2013, LNCS 8029, pp. 313–322, 2013.

awareness." Our work involves studying how such skills can be supported in online deliberation and collaboration.

Participants engaged in extended collaborative knowledge-building or problem solving eventually encounter moments of tension in which they are challenged to understand each other's perspectives and opinions. These moments are microcosms of and foreshadow key moments in the social and civic life of adults writ small and large. Both the literature on creative problem solving and the literature on civic deliberation emphasize the importance of having diverse perspectives represented in collaborative processes, but scholars often do not acknowledge the skillfulness needed to work productively with these differences.

We use the term "social deliberative skills" (SD-skills) to indicate the capacity to deal productively with heterogeneous goals, values, or perspectives, especially those that differ from ones own. SD-skill includes social perspective taking, meta-dialogue, social inquiry, systems-thinking (complexity thinking), and self-reflection. Though the teaching/learning/support (including computer-based support) of these related skills have been researched intensively, the prior research does not adequately address some key challenges in building mutual understanding and mutual regard when interlocutors encounter the disequilibrium of diverse perspectives. This research makes an incremental contribution in this area.

## 2 Background

One of the goals of education is to produce competent national and global citizens capable of participating in democratic self-governance and capable of wrestling with the difficult questions and dizzying array of information and opinion they face in our technologically advanced society. Engaging with others on complex topics requires not only learning the relevant facts and concepts and making logical inferences, but also engaging with the perspectives and opinions of others who may not share one's views or goals. Doing so requires skills that can be systematically supported (King & Kitchener, 1994; Rosenberg, 2004; Herzig & Chasin, 2006; Holman et al., 2007).

We differentiate our research from others that focus on *argumentation*, which aims to help learners generate logical, well-formed, well-supported explanations and justifications (Andriessen et al., 2003, Baker et al. 2007), usually framed in objective rather than intersubjective terms. That is, they are about finding the right answer or the most efficient and effective solution to a technical or scientific question—but don't adequately address the specific moments of deliberation or collaboration where opportunities for mutual understanding and mutual recognition arise.

Our research draws on prior studies of higher order skills in: social metacognition (Lin & Sullivan, 2008; Joost et al., 1998), reflective judgment and epistemic skill (King & Kitchener, 1994; Kuhn, 1999, 2000; Winne et al., 2006), social perspective-taking and empathy (Desiato 2012; Dahlbert 2001), and perspective seeking and question asking (Graesser et al., 2008).

Prior studies of computer-based support of higher order skills are directly applicable to our research on SD-skills (a subset of higher order skills). Researchers are

developing educational software that scaffolds metacognitive and higher order skills including inquiry skills, metacognition and self-regulated learning skills, and reflective reasoning skills (see White et al., 1999; Puntambekar & du Boulay, 1997; Azevedo et al., 2004; Linn, 2000), and evaluations indicate that such support can be quite successful (Baker et al., 2007; Suthers et al., 2001; Scardamalia, 2003). There has also been significant R&D in systems to support argumentation skills (Baker et al., 2007; Suthers, 2008; Scheuer et al., 2010). These studies indicate that under ideal conditions technological scaffolding in the form of prompts, awareness tools, and feedback can improve metacognitive skills, epistemological understanding, and other higher order thinking skills, though studies differ on the enabling conditions necessary for such improvement (Reiser etl all 2001; Suthers et al. 2001; Soller et al. 2005).

## 3 Method

For the online discussions we used the Mediem deep dialogue discussion forum software created by Idealogue Inc. (see Figures 1, 2).[1] In addition to standard (semi-threaded) discussion forum features, Mediem has a number of features intended to support deeper engagement and reflection (based in part on the designers' many years experience with members of the National Coalition on Dialogue and Deliberation).

**Hypothesis.** Participants were put in three experimental groups: 1) the "Vanilla" (control) group using only plain discussion forum features; 2) the "Sliders" group using a slider tool to rate opinions; and 3) the "Reflective tools" group using tools designed to support meta-dialogue, good question asking, and self-reflection (described below). The primary research hypothesis was that the features intended to support SD-skills, i.e. in groups 2 and 3, would be shown to do so based on hand coding of participant posts. We are also interested in relationships among skill use, posting activity, response relationships, and survey results.

**Mediem Features.** Mediem has been used in a number of dialogue contexts including interfaith discussions among college students. Figure 1A shows the Mediem home screen, with sections listing Dialogues ("Conversations"), Opinion Sliders, Participants, and Resources. Each section lists items that can be expanded for full view. Dialogues are semi-threaded discussion forums with additional features mentioned below. Normally participants in open-ended discussion will propose their own dialogue topics and "set the table" for a conversation by specifying certain parameters (number of participants, demographic information, etc.) and inviting others to join; however, in our study we used pre-determined dialogue topics entered by the facilitator. The Participants section shows participant profiles, and the listing can show graphical indications of demographic and other participant information. The Resources section allows participants to upload documents and links related to the conversation. We did not use the Participants or Resources features for this study.

[1] We worked with Idealogue to create an API for exporting the data from the dialogue (posts and other user actions) for our monitoring and data analysis. We also worked with them to build additional customization features supporting experimental trials.


**Fig. 1.** A, B: Mediem Home Screen and Sliders

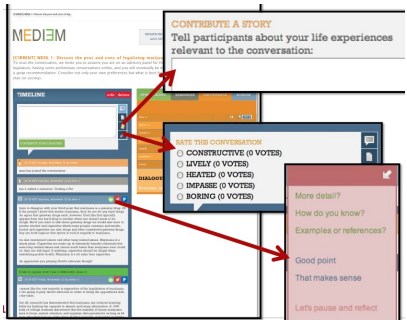


**Fig. 2.** Mediem Reflective Tools

The Mediem software was chosen for our study because it has a number of features designed to support deeper reflection and engagement. Figure 2 illustrates the expanded view of a Conversation (Dialogue), showing three such features illustrated separately. The discussion is viewed in the "Timeline" with most recent activity on top. Participants type their thoughts in the empty box at the top and submit. The Timeline shows posts and also other events (resources posted, conversation ratings, etc.) in temporal order. Posts are replied to using the arrow-shaped button above a post. To the left on the screen are tools for viewing participants, sliders, stories, and resources associated with the particular Conversation.

Figure 2 shows the three reflective tools used in the “Reflective tools” group. First is the Story feature, which gives participants a special place to say how the issue at hand relates to them personally, including relevant background information about themselves and "what is at stake" for them in the issue. Second is the Conversation Thermometer, a meta-dialogue tool that allows participants to rate (vote on) the quality of the conversation at any time. The choices can be customized by the administrator. Third is the Contribution Tag feature, which allows participants to give brief comments on other's contributions. It provides a fixed vocabulary similar to the sentence starters (or locution openers) used in other dialogue software, but the tags remain attached to the target post rather than starting a new post (see Soller, 2001).

The software includes an Opinion Slider, a polling feature used in the "Sliders" group, shown in Figure 1B. (As with Conversation topics, participants usually set up their own Opinion Slider questions, but ours were pre-defined for the classroom dialogues.) Sliders are thought to provide a motivational, brainstorming, and group-awareness function similar to Student Response Systems ("clickers"), which draw attention to differences, similarities, and diversity of opinion within the group as a whole. The slider gives a summary view of where participants stand on an issue.

**Participants and Discussion Questions.** Twenty six students in a college Alternative Dispute Mediation class discussed two topics (one each week over two weeks) in moderated discussions using Mediem. Students were randomly broken into three discussion groups of 8-9 members each, with all groups given identical questions. The activity was a required assignment that was part of the course and students were given class credit based on participation alone (not the content of participation). They were required to post at least once every day. In a prior class session students had brainstormed interesting and controversial topics for this activity. The discussion topics chosen were 1) Trayvon Martin killing in Florida, and 2) Gun Control.

**Facilitation.** We employed the service of experienced facilitators. To keep the control and experimental groups comparable, the facilitators were asked to keep their interventions to a minimum, and if they made an intervention in one group to do something similar, or at least something of similar length, in the other groups. Facilitator #1 facilitated all three groups during the Trayvon Martin discussion (week #1) and facilitator #2 facilitated all three groups during the Gun Control topic (week #2).

**Data Collected and Analyzed.** The three groups had similar numbers of students participating in the discussions (Vanilla 9, Sliders 8, Reflective Tools 9). There were 8 males and 14 females ranging in undergraduate grade level from sophomores to seniors, with one non-degree student. All text from student posts was collected; in addition, "reply" connections between posts were collected. Data were collected on Slider, Story, Conversation Tag and Thermometer use in the groups where these features were offered. All subjects were given a post-survey including 18 questions using a 5-point Likert "agree...disagree" scale.

**Coding.** Text of student posts was divided into segments and coded by two independent coders using a coding scheme developed by our group that focuses on social deliberative skills and other indicators of dialogue quality. Our coding scheme has 42 categories, 17 of which indicate deliberative skill. This scheme synthesizes prominent frameworks found in the literature (Black et al., 2011; Stromer-Galley, 2007; Stolcke et al., 2000) and adds codes for dialogue quality specific to SD-skills (Murray et al., in preparation). Cohen's Kappa Interrater reliability measure for this coding scheme is 71%, (76% agreement) averaged over five dialogue domains we have used it in(this level is considered "good" (ref) and is particularly good given the complexity of our coding scheme). For this classroom data that is the subject of this paper the interrater agreement is 77% and the Cohen's Kappa is 72%.

For this experiment, 7 codes were singled out for data analysis: *Intersubjectivity*: perspective awareness, perspective taking or question asking; *MetaTopic*: Birds eye or systemic view of the topic (related to complexity or systems thinking); *MetaD*: Meta-dialogue, discussing the quality of the dialogue and proposing changes to its structure;

*Appreciation:* Gratitude, affirmation of another's idea or situation); *Apology:* noting and/or taking responsibility for one's errors; and *Source Referencing*: mentioning a source for a fact or idea. A Total-SD-Skill score was computed for each segment by adding the scores of the seven skill measures for that segment. An average Total-SD-Skill score per segment was then computed for each student in each discussion.

Students who posted fewer than 5 times for both topics combined are excluded from statistical comparisons. Also, preliminary analysis revealed several issues with the Sliders group sufficient to lead us not to include this group; we compare only the Vanilla and Reflective tools groups.[2] Students in these two groups who met the criteria for inclusion happen to be balanced in total number and in gender, though not in grade level. Although the individual codes included in the study had been determined to show no effect due to grade (within-group ANOVAs ranging from $p = 0.25$ to $p = 0.78$), due to the difference in distribution of juniors and seniors, we continue to include grade as a potential factor in correlations.

## 4 Results

In this section we will report on: (1) the main question of whether the group using reflective tools showed higher (total and subskill) skill levels than the control (Vanilla) group; (2) look for possible relationships between SD skill scores and gender, post size and frequency, post reply statistics, tool use statistics, and survey results. Participation and basic statistics for the Vanilla and Reflective Tools groups:

- The data set over the two groups contains 241 posts and 516 segments; for an average of 15.06 posts for each student over both topics ($SD = 7.45$).
- The mean words per post was 53.60 ($SD = 42.12$) and the mean characters per post was 299.40 ($SD = 241.95$).
- We found no significant relationship between the number of posts and the length of posts among participants.

The average student skill scores as percentage of each student's segments were:

| Intersub | Meta_D | Meta_Topic | Apology | Apprec. | Fact_Src | Src_Ref |
|---|---|---|---|---|---|---|
| 25.08% | 0.88% | 5.51% | 0.22% | 1.30% | 0.28% | 1.20% |

The main results of the study include (see Stephens et al. 2013 for more detail):

- A main effect between Total-SD-Score and grouping, $F(1, 14) = 6.89$, $p = 0.02$*, $d = 1.46$ (a very large effect) in favor of the Reflective Tools group. Thus our main hypothesis was confirmed.

[2] In the Sliders group one student failed to follow instructions (did not use the sliders). This student dominated the discussion, contributing over a third of the total posts. Two other students in this group did not post enough to be included in the analysis. One student wrote a note to the facilitator claiming that one student in this group seemed overly critical and not respectful, which affected her feeling of safety.

- A significant relationship between Intersub and grouping, $F(1, 14) = 4.81$, $p = 0.05$*, $d = 1.05$ (a large effect) in favor of the Reflective Tools group. Intersub was strongly correlated with Total-SD-Skill, indicating that most of the effect of Total-SD-skill comes from the Intersub subskill. There was no significant relationship between any of the other subskills and group.
- ANOVAs revealed no difference due to gender on the Total-SD-Skill score or on any of the subskills except for Appreciation, where females scored higher, F (1, 14) = 5.59, p = 0.03. Six females had at least one segment coded Appreciation; none of the males did.
- From the survey, there was some positive correlation between Total-SD-Skill and self-reported Engagement (r = 0.44) and Learning (r = 0.21). These results conform to our intuitions that those exhibiting more skill would find the experience more positive, though we cannot infer causation in either direction.

Next we look more closely at two phenomena: the use of the reflective tools, and the reply structure among participants.

**Student Replies to Each Other.** The number of contributions that reply to (or refer to) other contributions is one indicator of a robust deliberation (Stromer-Galley, 2007; Suthers 2008). We analyzed several quantitative metrics related to this phenomenon. Our hypotheses were: 1. students with higher skill (especially the intersubjective code); 2. students showing positive survey opinions would post more replies; 3. the reflective tools would support more replies.

- The average number of posts per student that were explicit replies to posts of another student (Replies_by_me) were 10.59 ($SD = 3.41$), about 71%.
- The average number of replies each student received (Replies_to_me) was 10.35 ($SD = 6.86$).
- There was a correlation between Replies_by_me and Replies_to_me: R = 0.8284. In other words, students who replied more to posts of their fellow students received more replies in return.
- There was no main effect on Replies-by-me or Replies_to_me due to experimental group and no significant relationship between Replies_by_me or Replies_to_me and grade level within either group.
- There was no significant difference between genders in the numbers of Replies_by_me or Replies_to_me within the Reflective Tools group. However, within the Vanilla group, females replied to others significantly more often than males, t = 2.68, p = 0.04*; females replied more than twice as often as males.

In summary, our hypothesis that reflective tools would support more replies was not supported. A majority of the posts were replies to other posts and were replied to in turn; students who replied more to posts of their fellow students received more replies in return; and, interestingly females in the Vanilla group replied to the posts of others more than twice as often as did the males within that group.

**Use of Reflective Tools.** The reflective tools group had at their disposal a set of three tools that constitute innovations over what is offered by most discussion forum software: the scaffolded post comment tool, a discussion temperature rating, and a story

tool where participants could write personal stories about the topic (see Figure 2). We hypothesized that there would be a positive relationship between the amount of tool use and evidence of social deliberative skill (presumably because making use of the scaffolding supports bringing skills to bear in the dialogue, but causation can not be inferred from the data). This hypothesis was confirmed in finding a positive correlation between intersubjective speech acts and total tool use (R=.54) and dialogue temperature tool (R=.85) (this was for the Trayvon topic, as discussed below).

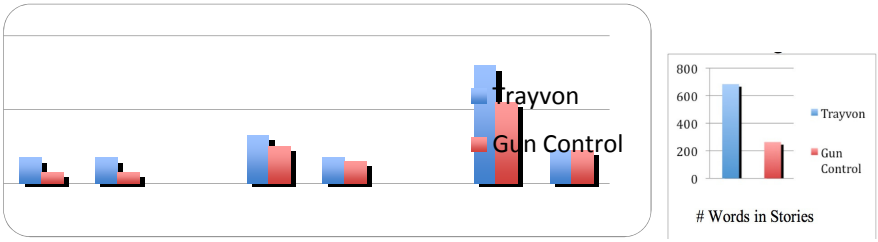


**Fig. 3.** A: Reflective tool use vs. topic; B: story words vs. topic

The amount of tool use is shown in Figures 3a and b. For this analysis we separated the data by discussion topic because we noted more tool use in the first topic, Trayvon Martin. As can be seen, students posted less in their stories, used the discussion temperature tool less, and posted fewer comments for the second topic (Gun Control). We believe this could have been due to several factors: the novelty and motivation to do this homework task could have worn off after the first topic; the Trayvon topic was more specific (involved specific people) and could have been related to more easily than the Gun control topic; Trayvon was salient from recent news reports; the second topic was facilitated by the less experienced facilitator. In general, the participation levels in the reflective tools group were acceptable but not particularly high. This concurs with the average survey Engagement rating, 4.0 in a 1-5 scale. This analysis also highlights the potential large effects of choice of topic and other context variables on measures of student deliberation and problem solving.

## 5 Summary

Internet-based social and technological innovations usually support increasing *quantities* of information and connectivity (e.g. the growing WWW, number of FaceBook friends, number of email and text messages per day) without supporting—and sometimes sacrificing—its *quality*. We join those calling for research and development of online systems that support communication and information quality, specifically, supporting more reflective thinking, deliberative dialogue, and mutual understanding in communications. This study suggests that simple scaffolding features can increase skillful deliberation online. We found a significant effect with (very) large effect size of reflection tools as supportive scaffolding for SD-skills.

Our attempts to use text classification to automate SD-skill assessment lead to only modest results, and we are working on further machine learning models for SD-skill classification, with earl encouraging results (Murray et all 2012; in submission; Xu et al. 2013). We are also developing a Facilitators Dashboard for visualizing deliberative dialogue properties and showing the visualizing the results of real-time automated analysis. Identifying methods for gently and broadly scaffolding SD-skills in online deliberation could impact many contexts: knowledge-building, situated learning, civic engagement, and dispute resolution.

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