

A Needs Analysis for Instructional Support in LegSim

Mahesh Joshi, Carnegie Mellon University, 5000 Forbes Ave. Pittsburgh, PA 15213, maheshj@cmu.edu
Yi-Chia Wang, Carnegie Mellon University, 5000 Forbes Ave. Pittsburgh, PA 15213, yichiaw@cs.cmu.edu
John Wilkerson, University of Washington, Seattle WA 98195, jwilker@u.washington.edu
Carolyn Rosé, Carnegie Mellon University, 5000 Forbes Ave. Pittsburgh, PA 15213, cprose@cs.cmu.edu

Abstract: The primary research question we address in this paper is the extent to which participation within a well-established game-based learning environment for Civics instruction called LegSim (Legislative Simulation) supports the needed development of argumentation skills. Our analysis suggests that although environments like LegSim offer great potential for providing students with valuable opportunities to develop important skills, active support during participation is needed to ensure that students take these opportunities when they are presented (1).

Introduction

Recent developments in research point to computer-based simulations and games as valuable tools for promoting learning (Alessi, 2000; Dorner, 1996). One focus of our research has been to develop methodologies for advancing critical thinking and argumentation skills in a political science simulation called LegSim (Wilkerson & Fruland, 2006; <http://www.legsim.org/>). LegSim is primarily designed to teach legislative procedures and strategies to the students of a college-level political science course. Within LegSim, students assume representational roles and advance legislative proposals that reflect their own political priorities. Undoubtedly, it is successful in terms of providing students the opportunity to practice the procedures they are learning in the didactic portion of their course with respect to the functioning of a legislature. The work reported here, however, is not aimed at a formal assessment of the extent to which students learn legislative procedures. The question we address in this paper is the extent to which the environment supports the development of argumentation skills, and what needs exist in environments like LegSim for support either by instructors or by intelligent agents that are able to participate in the conversations, as in some recent work in the area of dynamic support for collaborative learning (e.g., Kumar et al., 2007). To that end, we present an analysis of a semester's worth of discussion data within the LegSim environment in order to shed light on the opportunities for argumentation and critical thinking skills development and how students may or may not have taken advantage of them. For our analysis we chose to explore the data from one college level class over a whole semester. 93 students participated in the course, with LegSim as a central part of the course.

Longitudinal Data Analysis

Among other things, LegSim includes features that allow students to participate in "floor debates" in the form of online discussions, where they are able to post comments and opinions regarding the proposed legislation (a.k.a. a bill). As is true in the real Congress, most of the bills that are introduced will never be brought up for a vote, and as a result, many will never be debated. If there is a vote, a voting position can be 'yes', 'no' or 'present', the last category being equivalent to a neutral opinion on the bill. Over the course of the semester, 304 bills were proposed by students. Of these, 99 were promoted to the floor by their respective committees. And of those, only 48 were discussed in the floor debate forum. Our analysis focuses on the comments posted for those bills that were debated, including 479 comments posted by 71 students.

Our analysis was guided by two focal questions: (1) Where do we find opportunities for students to experience successes and failures in their argumentation? (2) To what extent do we find evidence that students gained competence in their argumentation ability over the course of the semester? We present this analysis as a needs assessment, which leads to specific recommendations for support within environments like this. In our analysis, we were interested both in how effective student arguments were in swaying each other's opinions as well as in the structural characteristics of the arguments, i.e., how sophisticated they were from a structural standpoint. To that end, we have coded the comments posted by the students along two dimensions. The first dimension is the sentiment or orientation of a comment towards the proposed bill (positive / negative / neutral). With each comment coded this way, we can detect shifts in student positions on a bill over the course of a conversation or before they vote, as well as success of argumentation in terms of swaying the overall vote. The second dimension is the quality of argumentation found within each comment (high quality argumentation / medium quality argumentation / no argumentation). The argumentation quality dimension in particular may be interesting from the perspective of a course instructor who uses the LegSim system in his/her course, if one of the goals of its use is helping students to learn better argumentation skills in the political science domain.

In our data, only about 40% of bills came up for a vote before the last 10 days of the semester, and only about 15% of them came up for a vote before the last 20 days of the semester. Thus, while the strongest

experience of success or failure of argumentation would come from having argued for or against a bill, and then seeing the vote come out either consistent with or inconsistent with that argumentation, few opportunities of that nature were forthcoming for students until relatively late just because of how the timing played out.

A more limited sense of success or failure could come from students making an argument and then seeing other participants in the conversation swayed to change their position. However, there were only four cases where students changed their position from the position expressed in their post(s) to the position expressed by their vote, with only one comment possibly reflecting a change of opinion due to arguments from others. When comparing the positions expressed in the on-line debate with the final vote cast by the students, we found only eight comments corresponding to five bills where the vote cast was exactly opposite to the sentiment expressed. However, all except one of these five bills were scheduled for vote in the final week of the semester. Since students did not have the opportunity to observe both successes and failures on this level, and since failure to convince others was the norm regardless of the quality of argumentation, it seems doubtful that the failures to sway partners would be felt as failures, or if they would be perceived as related to the quality of argumentation.

One reason why we may have observed so few changes in position could be because it was relatively rare for the same student to post more than one substantive comment on the same bill. We find evidence that students did not always thoroughly express their positions. At the extreme end, 22 out of the 93 students in the course never participated in any of the floor debates. There is evidence that the students who did post were the ones who felt most strongly about the bills. In particular, using a binary logistic regression with student id, bill id, and vote status as factors, with a binary indicator of whether at least one comment was expressed by the student for that bill as the dependent variable, we find that students who voted either positively or negatively on a bill were significantly more likely to post at least one comment on the associated bill than students who were either absent or abstained from voting ($p < .05$). Thus, while there is evidence that overall students are enthusiastic about their participation in the LegSim environment, there is evidence that valuable opportunities for participation are missed in cases where students do not feel strongly about a bill.

Just as we have trouble finding evidence of opportunities for developing strong epistemological beliefs about argumentation based on participation, we also do not find evidence of an increase in sophistication in argumentation as the semester progressed. For this analysis, we observed the proportion of comments exhibiting high quality argumentation between the beginning third, middle third, and final third of the semester. Much to our surprise, the trend was for a higher proportion of comments submitted early in the semester (42%, with only 8 different students contributing at least one comment) to be high quality than in the middle (18% from 47 students) or at the end (24% from 62 students).

Discussion and Current Directions

The analysis of LegSim data casts doubt that providing a game environment alone, although it may be highly engaging for students, is enough to stimulate the development we would like to see in students. Thus, our conclusion is that instructional support is needed to actively steer students towards opportunities to learn, and thus research is needed to further develop technologies that would make support within multi-player environments like this feasible, such as technology for automatic collaborative learning process analysis (Rosé et al., in press), and interactive collaborative learning support (Kumar et al., 2007). Such technology could be used to prompt students to voice conflicts that have not yet been articulated or to encourage students to elaborate bald claims with warrants, data, and qualifiers. A further application of automatic analysis could be to give instructors insight into the dynamics of the conversations and how student argumentation is developing.

Endnotes

(1) This work was funded through ONR Cognitive and Neural Sciences Division grant N000140510043.

References

- Alessi, S. (2000). Building versus using simulations. In J. M. Spector & T. M. Anderson. (Eds) *Integrated & holistic perspectives on learning, instruction and technology: Understanding complexity*. The Netherlands, Kluwer: 175-196.
- Dörner, D. (1996). *The logic of failure: strategic thinking for complex situations*. New York, Henry Holt and Company.
- Kumar, R., Rosé, C. P., Wang, Y. C., Joshi, M., Robinson, A. (2007). Tutorial dialogue as adaptive collaborative learning support. In *Proceedings of AIED 2007*, 383-390.
- Rosé, C. P., Wang, Y. C., Cui, Y., Arguello, J., Stegmann, K., Weinberger, A., Fischer, F., (In Press). Analyzing Collaborative Learning Processes Automatically: Exploiting the Advances of Computational Linguistics in Computer-Supported Collaborative Learning. *International Journal of Computer Supported Collaborative Learning*.
- Wilkerson, J. & Fruland, R. (2006). Simulating a federal legislature. *Academic Exchange: Teaching Political Science*. 10(4).