Developing Collaborative Argumentation Systems: What Advice Do the Experts Have?

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Abstract: The use of computer-based tools to teach argumentation skills has recently become quite popular. To understand the breadth of activity in this area, bridging between published results and real-world development, we conducted a survey in which 97 argumentation experts participated. Based on data from the survey, this paper summarizes the rationale and motivation behind design decisions, important lessons learned, and future research directions.

Introduction

Even though argumentation is essential for "survival" in the modern world, people often have problems in arguing in well-founded ways (Kuhn, 1991). In addition, teaching of argumentation skills is difficult due to the ill-structured nature of argumentation, and not very common, due to limitations in teachers' time and availability. Computer-based argumentation tools have been one answer to this issue. As a recent review of tools and research reveals (Scheuer et al. 2010), there are a variety of different approaches that have been employed. The review highlights promising attempts to teach argumentation skills, but was limited to published results and available tools, which often do not reveal design decisions and the rationale behind them.

In this paper, we extend prior reported results of a survey aimed at bridging between published results and real-world development by focusing on the development of argumentation systems (some, but not all, of which were collaborative) (Loll et al., 2010a, b). More specifically, we report on what experts in argumentation have learned over the years. By documenting these lessons learned, our goal is to provide guidance for future research and development of educational argumentation systems, particularly those focused on collaborative learning of argumentation.

Methodology

To collect experts' experiences with argumentation systems, we conducted a web-based survey among selected experienced argumentation researchers, teachers, and developers. The selection was done via a systematic search through the author lists of relevant conferences (e.g., CSCL, ITS, AIED, COMMA, ISSA) and journals (e.g., ijCSCL, IJAIED) and extended by means of additional web searches for experts. In this paper, we will focus on the results of the last part of the questionnaire, which consisted of three open-ended questions regarding the *development of argumentation systems*. Based on self-reported expertise, we asked experienced developers the following three questions:

(1) In the argumentation system (or systems) that you have designed and/or developed, what would you say was the best feature? Why?
(2) Can you briefly describe the types of flexibility and/or configuration you provided in the design of your argumentation system (or systems)?
(3) What would you say was the most important lesson (or lessons) learned in designing, developing and/or testing your argumentation system?

Overall, we received responses from 97 out of 153 invited experts. The experts' responses were coded by means of a hierarchical tree-based approach independently by two coders resulting in an adequate inter-rater reliability (between 65% and 90%). Remaining conflicts were resolved by discussion.

Results

The "best" argumentation system features (Q1) reported by our experts can be categorized into four groups: First, the *usability of the system*. This includes an appropriate argument visualization, the most frequently mentioned desirable feature. Relatedly, it was frequently mentioned that visualizations with multiple representations (e.g., graphs, tables, threads) are highly desirable. Second, *flexibility and configurability with respect to the underlying argument model* was cited as quite helpful, for instance by means of configurable ontologies (elements available to model the argument). Third, *good pedagogical design* was often mentioned, meaning support for, for instance, group formation and the assignment of roles, micro-/macro-scripting in

connection with fading of scaffolds as well as game features to enhance the participants' motivation. Finally, the provision of *feedback to the argumentation process* was highly cited, including automated feedback and support for manual feedback from moderators and/or teachers.

Whereas flexibility was identified as one of the "best" features, question Q2 clarifies more specifically what is meant by flexibility. Here, one kind of flexibility mentioned was *technical flexibility*, including platform independence, flexible data representation and interface configuration (such as the ability to toggle system features on and off). *Argument model flexibility* was highly regarded, including the manipulation of elements representing argument parts (e.g., shape, size) and their details (e.g., font colors), the definition of constraints to enforce a specific argument structure (such as argument – counter-argument chains), and the use of questions to scaffold the argumentation process. With respect to collaboration, the importance of *a rich repository of collaborative features* was stressed. This includes, for instance, the assignment of roles and associated access rights, the definition of individual and collaborative work phases, and the support of awareness mechanisms, (e.g. an alert whenever a user modifies controlled parts of the argument). Finally, the *flexible support of feedback* was highlighted. Here, the systems either support argumentation directly by giving feedback to the arguers or indirectly by informing a tutor/moderator of possible problems.

With respect to Q3 (i.e. the lessons learned), the majority of the experts agreed on the slogan "*Keep it simple*". The simplicity of a tool, including the underlying argument model as well as the user interface was widely acknowledged as key to motivation (as less training is required) and – directly connected to it – success of the system. Thus, the provision of additional system features and functions (e.g., AI support, scripts, etc.) should be carefully evaluated before use, as these can increase overall complexity. However, even with a simple system, it is not guaranteed that empirical evaluations of promising approaches will result in success due to the complex nature of argumentation. Connected to this point is the fact that a graphical representation will not automatically lead to improved argumentation skills, per se, but its strength and weaknesses must be considered in combination with a vast set of other factors (e.g., gender, group size, task) that are largely unexplored and will require more in-depth analysis in future.

Discussion & Limitations

The present results support prior findings with respect to collaborative argumentation learning: The process of collaboration appears to be best supported with structural means such as visualizations and ontologies (e.g., Suthers, 2003) and guidance, such as with collaboration scripts (Stegmann et al., 2007). On the other hand, it is essential to walk a fine line between helping learners with many features and keeping things simple. A highly complex and hard-to-use tool can obviously result in cognitive overload and demotivation of learners. To effectively use educational argumentation tools, training of both students and teachers is required. In addition, both teachers and students should be involved in the overall development process in order to recognize problems early.

Regarding the potential of computer-supported argumentation, our results also indicate a trend toward making systems as flexible as possible. With respect to the evaluation of the effect of argumentation systems, one should bear in mind that teaching argumentation skills is usually a long-term process. Thus, short-term evaluation of tools that attempt to foster these skills may not result in significant effects.

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