Open-Source Argumentation: A Flexible System Design

Gordon Graber
School of Information Science and Learning Technology
University of Missouri, Columbia Campus
United States
glgqk3@mail.missouri.edu

Abstract: This paper examines the design of a Web based structured discourse system created by modifying open-source discussion forum software. The design layers the forums Web display and functional structure of forum posts and replies above the underlying forum database, minimizing the modifications necessary to turn nearly any discussion forum into a structured discourse system. The flexibility inherent in the design allows instructional designers to tailor the system to specific discourse activities, such as argumentation and knowledge representation.

Introduction

Learning systems which couple instruction and learning activities into integrated environments have the potential to benefit learning by directing, structuring and scaffolding student work, as well as reducing extraneous cognitive load (Van Bruggen, Kirschner & Jochems 2002). In Problem Based Learning Environments (PBLE), many Computer Supported Collaborative Learning (CSCL) Tools are available to educators, but some, due to their proprietary nature, evade the tight integration desired by PBLE designers. Students are left in PBLE coordinating a Learning Management System (LMS) with a number of disparate applications and documents containing instructional content.

Open-source LMS and Discussion Boards (DB) afford customization which can alleviate students' management efforts by allowing designers to use dynamic Web applications development principles to stitch PBLE into seamless learning experiences. For example, the same DB can be layered with different features, offering different representations and related activities - such as structured discourse, knowledge representation, and argumentation - using the same underlying DB engine. This paper examines the design of a structured discussion system (accessible at StructuredForums.org), which was layered on the open-source DB, myBB (myBB.com 2010), based on a system created by and Jonassen and Rimdez (2002), and proposes that by leveraging system designs common to Web based DB, there is no need to completely reinvent the wheel to accommodate specific discourse activities.

Environments for Argumentation

Argumentation in research and education has been supported by dozens of computing applications (Argument Mapping Tools 2010; Austhink 2010; Visual Literacy 2010). These systems target argumentation activities directly or may be used to support them (e.g. Mind Map tools; analysis tools). Many of these tools are now no longer in use; or are no longer supported. Those that remain in use may be categorized into proprietary systems that target specific computing platforms (e.g. Rationale, 2010 - Windows); proprietary to specific knowledge domains (e.g. Oyez, 2010 - legal argumentation,); proprietary to specific argumentation theoretical frameworks (e.g. Rationale, 2010 -Toulmin Structures); those that are coupled to specific visual representations such as argument maps (e.g. Belvedere, 2010; Rationale, 2010); those used purely for research analysis purposes and not meant for practical use in the classroom (e.g. Genie, 2010); those built upon Web based HTML and CSS standards (e.g. DebateGraph, 2010). None are integrated into Learning Management Systems (LMS) such as Blackboard, Moodle, and Sakai – integration that would enhance their usefulness in education and research – or are flexible enough to be used in different knowledge domains, or afford multiple visual representations of the discourse they embody.

This list of argumentation application categories is meant neither exhaustive nor definitive, but illustrative of the problems educators face when choosing and using applications that support argumentation and its analysis: to date, argumentation support systems have been proprietary in one way or another and disintegrated with the practices of online LMS. At a conceptual level, structured discourse support systems are generally inflexible in the range of structuring options they allow instructional design – the representational notation (Suthers, 2001) each tool affords is limited to a narrower range of discourse activity (e.g., legal argumentation), because the representational notation is bound to the tool's implementation. Alternatives to these proprietary systems are available: open-source LMS do support structured discussions activities as a standard feature in the form of simple threaded discussion forums which contain nearly all of the elements necessary to embody a flexible system. If we wanted to make argumentation and other forms of structured discourse widely practicable in education, we could look to these familiar discussion systems as the foundation of structured discourse support.

A Structured Discourse Design

The structured discourse system Jonnasen and Remidez created, built upon an open source threaded DB system (Shadow netWorkspace 2010), was used to guide structured discussion activities by, essentially, relabeling the common "create post" and "create reply" links (or buttons we encounter in DB) with the type of discussion post the students would create (e.g., "Claim"; "Counter Claim"; "Evidence"; or "Rebuttal") as well as guiding the response with a description (scaffold) of the label's meaning. The system included an authoring function so that the instructor was able to configure a hierarchy of post and reply types with corresponding labels and descriptions, among which students would choose when creating a post. Using the authored result constrained the semantic flow of the threaded replies in the DB, and the content students supplied in response (e.g., the possible replies to a Claim are Evidence and Rebuttal; the possible replies to Rebuttal are Evidence; and replies to Evidence are not allowed). In structuring student discussions, their design integrated instruction into the discussion activity, as opposed to simply supplying students with a set of written instructions at the outset of a DB activity, by reconfiguring the post link labels intelligently, according to the logic of the hierarchy of post types the author creates; and by scaffolding the intent of the reply type choices in the description of the expected response. Their design and implementation presents advantages over many of the other discourse and argumentation systems we find available today.

Jonassen and Rimdez's design addresses potential LMS integration by its implementation in an Web based DB which could be plugged into popular LMS such as Sakai, Moodle, or Blackboard. In addition, the authoring system they imbedded in the discussion forum lays the foundation of a flexible discussion guidance support system that can potentially be turned to multiple discourse purposes. (Their research stopped short of a generalized, multi-purpose treatment of semantically guided discourse activity, a discussion of which will be left for a future work.)

Modification for Functionality and Representation

Web based DB are database driven, in which a number of related database tables contain the data for Forums, Threads, Posts (and users). Data from the tables are used to populate the Web based interface of the DB. The Forums table contains entries for multiple forums; the Threads table contains multiple threads with a relational link to the Forums entry the thread is related to; the Post table contains entries for each user post with a relational link to the Threads the specific post entry is related to. Additionally, in hierarchical (threaded) DB, the Post table typically contains fields which relate each post reply to its the parent and child Post entry; as well as the post's subject and body (see figure 1). Linking post entries to their parent and child (reply) posts affords a hierarchical display of the discussion thread, and implies an elementary semantic relationship between the posts, which is necessary for structured discussions.

The open-source DB used in this design, myBB, was modified to include a Schema Structure table. The Schema Structure table contains entries in XML format which, in turn, structure the hierarchy of posts and allowable reply types, and contain the post type descriptions (scaffolds) (see figure 2). Fields need to be added to the Forums and Threads tables in order to link each Forum and Thread table entry to the Schema Structure entry applied to the specific forum or thread. Lastly, a field linking each post (or reply) to the particular reply type with the XML schema structure is added, so the system can introspect which reply scaffolds need to be displayed when a student replies to a given post.

The business logic linking a forum, thread, and post, to a specific schema structure, and its enclosed reply type choices, is contained in Javascript code attached to the specific thread Web display page. When a student clicks on a reply link, the Javascript code arbitrates the interaction, determining which entry in the schema structure the current post, being replied to, belongs. The Javascript arbitrator then looks up the scaffolds, of the possible reply types, for that entry and displays them for the student to choose from (see figure 3). When the student makes a choice of reply type, Javascript passes the schema reply type to the DB subject and body entry Web pages, storing the reply type in the Posts table entry for that reply. In this fashion, the Javascript arbitrator is able to introspect which schema structure should be applied to a given thread, and which reply types are allowed in response to a given post.

In addition to arbitrating the interaction between student and structure schema, the Javascript logic, in conjunction with CSS, also controls the display of the reply type choices presented to the student. Given that open-source DB use template systems for thread and post display, Javascript could equally have a hand in the Web representation of the forum threads and posts. Placing the schema structure in a single table within the DB database, in an XML format, coupled with the Javascript arbitrator to interpret the schema structure and guide the student responses as well as the outward display of the DB activity, allows a designer to quickly swap a different schema structure and arbitrator, instantly changing the nature, content, and look of the post-and-reply interaction.

Lastly, an authoring system was created to populate the Schema Structure table with schemas necessary to guide the structured discourse (see figure 3). The authoring system is layered at the page level in the same manner as the post-reply interaction system, allowing authors to quickly create new schema structures and attach them at either the forum or individual thread level. In this way educators could devise different structured discourse activities for each individual thread, and create starter posts, using the different schema, for students to respond to; or apply the same schema structure to an entire forum, forcing all thread activity in the forum to adhere to the same schema structure.

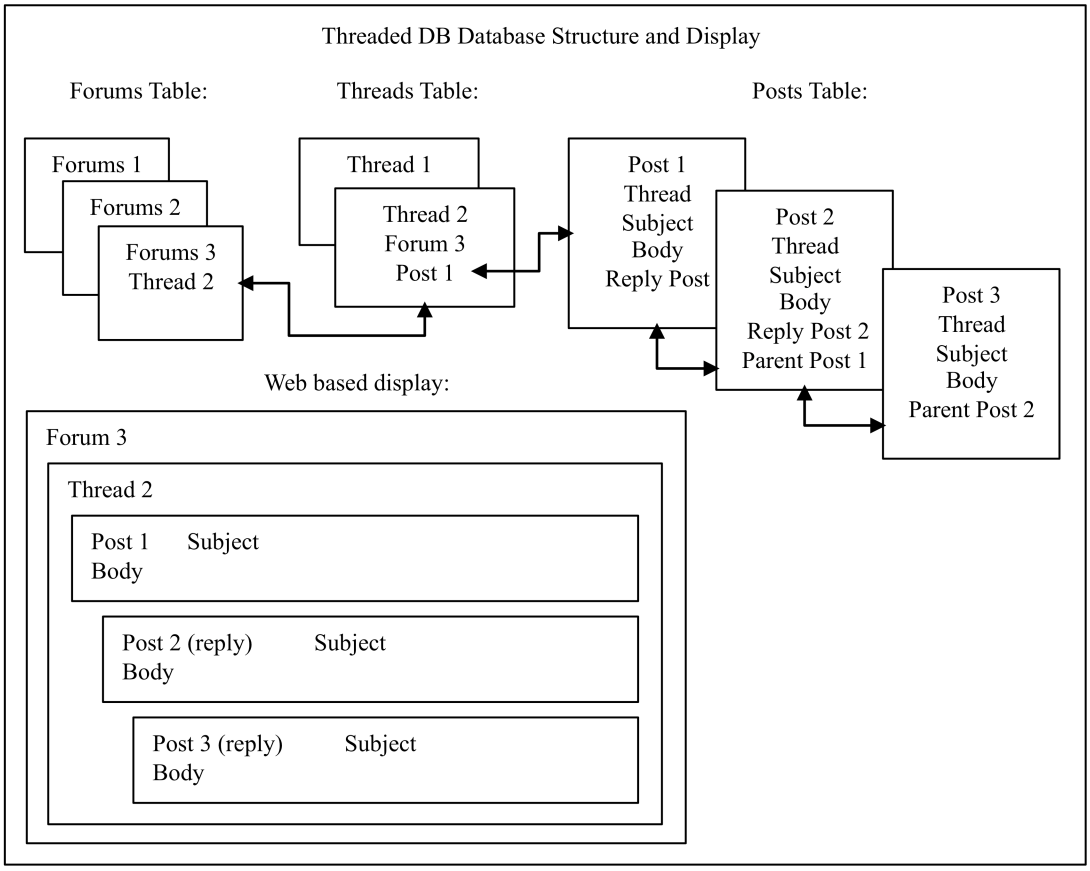

Figure 1: Simplified representation of a typical DB relational database structure in a hierarchically threaded discussion forum, and an example Web page display.

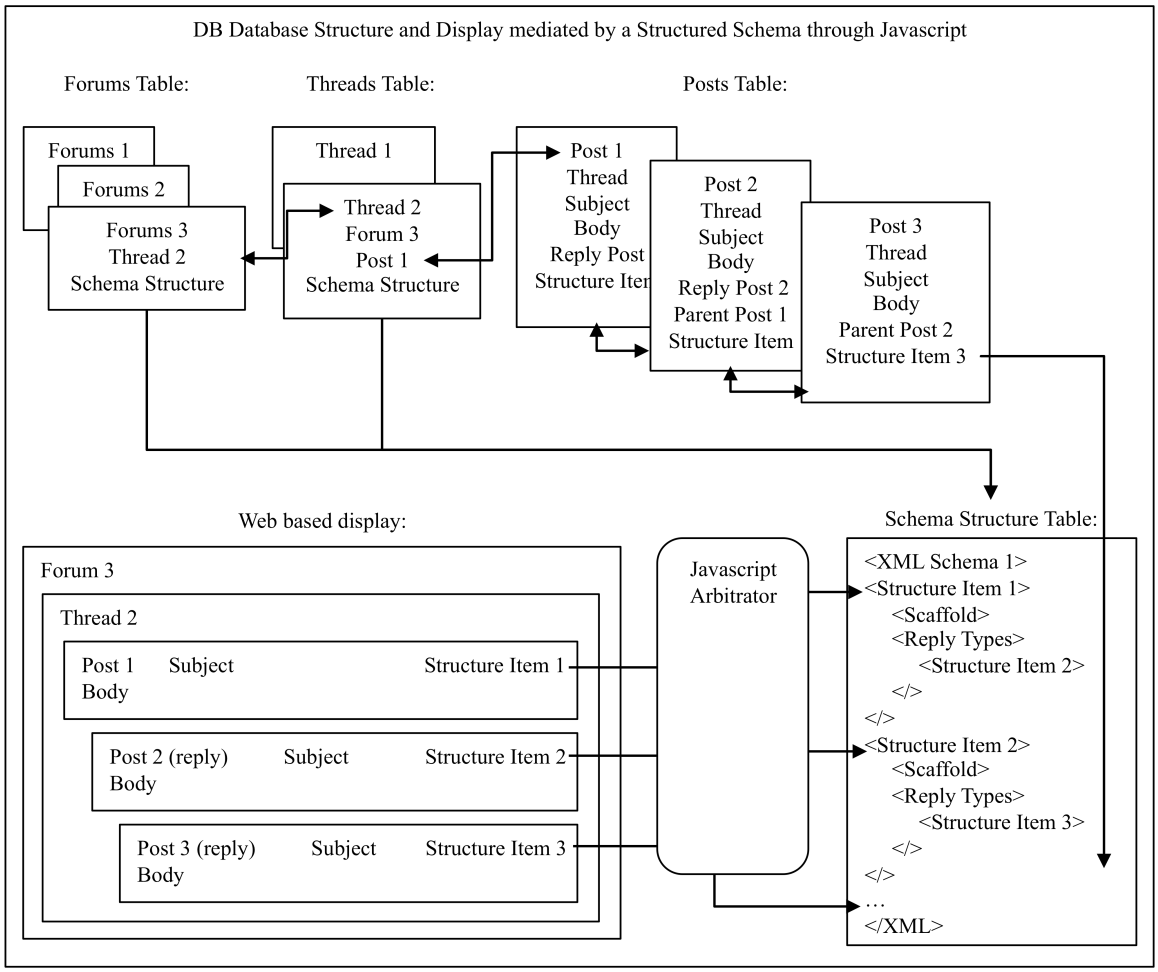

Figure 2: Simplified representation of a typical relational DB database structure, layered with a semantic schema structure necessary for complex and flexible structured discourse activities.

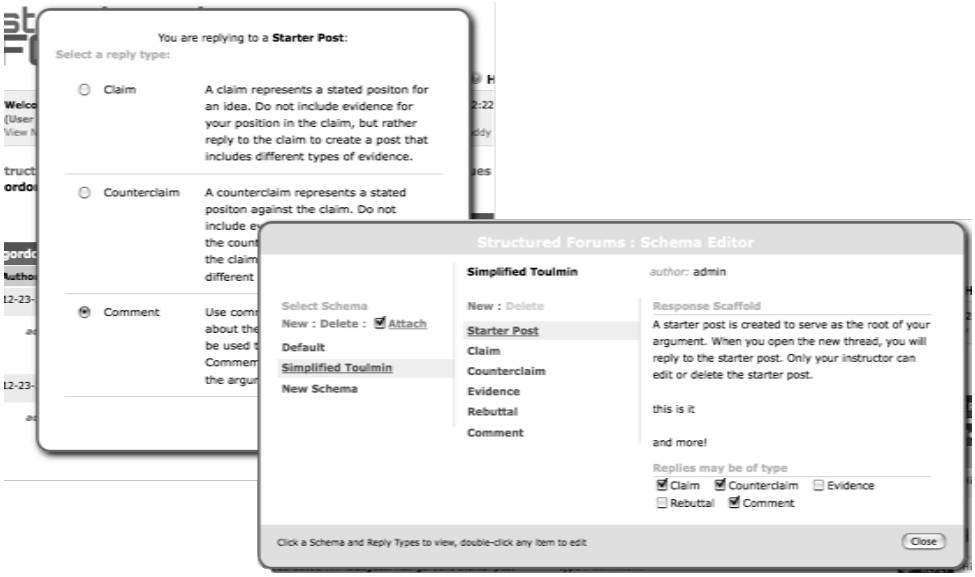

Figure 3: Screen shots of sample reply interaction, and schema structure authoring system.

Conclusions

This project illustrates that, with a minimum of modification to a DB underlying database, a richer structured discourse system can be effected that with traditional DB. The system is flexible in allowing different schema structures to be accessed. Substituting new business logic, arbitrating the structured interaction, allows completely new displays and interactions. Open-source systems avail themselves to such modifications, but are no without their downsides. These include the costs of maintaining customized systems in time and effort when updates are implemented, as well as documenting and supporting use.

The benefits of offering students custom and seamless interactions with learning content, which are tailored to the needs of the learning involved in specific domains, are ready to be realized, and can be brought to new heights. Beyond easing the extraneous cognitive load, custom systems afford an integrated learning experience which cannot be effected in the same way by traditional online course delivery.

The next step in this project is to build interactive element authoring directly into the reply type scaffolds, allowing educators to engage students directly in learning activities within structured discussion forums, rather than pairing discussions with external activities. Parties interested in testing the system are encouraged to visit http://www.structuredforums.org. The author is looking for collaborators who would be interested in using and the developing the system, and should contact the author.

References

Austhink, Critical Thinking on the Web. found at http://austhink.com/critical/pages/argument_mapping.html, September 2010.

Argument Mapping Tools, Carnegie Mellon University, found at http://www.phil.cmu.edu/projects/argument_mapping, September 2010.

Belvedere 4.1**,** found at http://belvedere.sourceforge.net, September 2010.

DebateGraph, found at http://debategraph.org/home, September 2010.

Jonassen, D., & Remidez, H. (2005). Mapping alternative discourse structures onto computer conferences. *Int. J. Knowledge and Learning*, Vol. 1, Nos. 1/2, pp.113–129

Rationale, Austhink, found at http://rationale.austhink.com, September 2010.

Shadow netWorkspace, found at http://shadownet.sourceforge.net, September 2010.

Suthers, D. D. (2001). Towards a Systematic Study of Representational Guidance for Collaborative Learning Discourse. *Journal of Universal Computer Science, 7*(3), 254-277.

Oyez, found at http://www.oyez.org, September 2010.

Van Bruggen, J. M., Kirschner, P. A., & Jochems, W. (2002). External representation of argumentation in CSCL and the management of cognitive load. *Learning and Instruction, 12*(1), 121-138.

Visual Literacy, Mapping Tools, found at http://www.visual-literacy.org/pages/maps/mapping_tools_radar/radar.html, September 2010.

Acknowledgements

The author wishes to acknowledge the assistance of Dr. David Jonassen, Professor Emeritus, University of Missouri; in the system design, and Camille Dixon-Dean, University of Missouri, during the course of the project and preparation of this paper.