

Making an argument



Drs Niels Pinkwart and **Bruce McLaren** outline the project that has created a web-based platform for student argumentation and debate



Could you begin by outlining the aims of the Learning to Argue: Generalized Support Across Domains (LASAD) project?

The basic aim of LASAD is to create and test a generalised framework and methodology for web-based argumentation to assist student learning. Additionally, the goal was to create technology that could support argumentation instruction in different domains (eg. the law, ethics, science) and that could be used collaboratively (ie. by multiple students working and learning together).

Could you explain how the LASAD program works, and outline some of its key features?

LASAD allows a user to define an ontology for a specific domain of use, and create student users for that domain and argument maps (visual representation arguments). An ontology is composed of a variety of elements that are provided to students to allow them to (jointly) develop argument maps. Within a shared web workspace provided by LASAD, the students can engage in a debate, linking their arguments to those of their fellow students. They do this by dragging and dropping shapes (eg. 'fact', 'claim', 'conclusion') into the workspace, typing text into the shapes that represent their arguments, and linking their argument to those of other students using the appropriate link types (eg. 'supports', 'opposes').

How do you intend the LASAD program to be used?

Our primary aim in developing LASAD was to support research projects that are investigating argumentation and the learning

of argumentation. In the field of Computer-Supported Collaborative Learning (CSCL), for instance, there are many researchers investigating various aspects of collaborative argumentation and how students can best learn argumentation. The concept of 'scripting'

argumentation is an area of particular interest in CSCL. A script is a set of roles or phases that are designed to structure student activities as they develop arguments and learn about argumentation. The LASAD system can be used to enable these structured learning processes.

Could you highlight some of your key achievements from the second funding phase (2010-13)? How did this build on work from the first funding phase?

We extended and tested the conceptual framework (ie. the abstract representation of the key argumentation components and their relations). The initial version of this framework was developed during the first two years of the project. The empirical studies conducted with LASAD made clear the need for new extensions. Also, the addition of the scripting engine and authoring tools led to an extension of the conceptual framework.

Our ultimate goal is to make LASAD usable as a research tool capable of testing a variety of argumentation learning approaches (and hypotheses about these approaches) across a variety of domains, both for our own research and for that of other educational technologists and learning scientists. We have made significant strides in this direction during the past two years.

Your key achievements in years three and four involved technical enhancements to the software to make it easier to use. How did you go about this?

We developed an authoring tool to make LASAD more usable and configurable over a

wide range of domains. We extended the Analysis & Feedback engine to make it more robust, with additional functionality. For instance, it is now capable of detecting a wider range of patterns, allowing users to be much more specific about the types of argument constructs they are interested in identifying. We added micro-scripting functionality to LASAD (ie. the ability to guide smaller student steps), and stabilised the software so that it is capable of being used in live studies with many concurrently working users. To help users understand and navigate within complex argument maps, we implemented a mini map function. This displays a small, summarised version of the argument map, and indicates the currently zoomed-in portion of that map with a rectangle.

You both have backgrounds in computer science (CS). What led you to develop a software tool for education?

Although we are computer scientists by training, we have published extensively in the areas of educational technology and learning science and continue to make contributions to both. More generally, it is clear that educational technology research is making its way into the broader CS field. In fact, software tools designed to support education belong to the very core of CS in that they bring together aspects of human cognition and computer system design.

Could you outline any other ongoing projects? What are your hopes for the future of LASAD?

We have a number of ongoing projects in the field of educational technology. For instance, the FIT project investigates novel Intelligent transport systems (ITS) methods which extend the applicability of ITS systems to ill-defined domains by means of machine learning techniques which can autonomously infer structures and feedback options from given data (eg. student solutions). A challenge (and a connection to the LASAD project) will be to apply the FIT research results to the argumentation field, thus allowing LASAD to give students better automated feedback to argument maps they created.

Answers for argumentation

LASAD has developed a framework for web-based argumentation, taking research in this area to a new level

ARGUMENTATION IS THE use of reason to bring an argument to a logical conclusion. It can be applied across many types of interaction, from an international political debate to a personal conversation. Specifically, the structures of different types of argument are established and analysed. Argumentation plays an important role in a variety of disciplines, including the law, politics, science and ethics, to name but a few. In the law, for instance, the study of argumentation is considered essential for an attorney to construct an argument to be presented in court.

'Learning to Argue: Generalized Support Across Domains' (LASAD) is an elegant piece of computer-based educational technology, designed with the aim of facilitating and supporting the study and practice of argumentation. It provides not only an online platform on which the argumentation can take place, but tools with which to analyse both arguments and styles of argument. It also has the capability to provide students with instructional feedback. A variety of components have been researched and developed in order to build this powerful piece of technology. Professor Niels Pinkwart, one of the principal investigators of LASAD, along with Dr Bruce McLaren, explains: "We have developed a reusable ontology of argumentation objects, a large set of visual, analytic and pedagogical components that can be combined in various ways to create a spectrum of educational argumentation systems, and an interoperable software system architecture that allows the flexible integration of the different methods and components".

The motivation behind the LASAD project arose out of a lack of general-purpose software to support argumentation. Although other argumentation software and computer-based systems have been in use for some years, these were generally restricted to a single domain. The objective of the LASAD project was to create a system that transcended these boundaries: "There are very few systems that are general-purpose in that they a) are general enough to be used in different argumentation domains, b) are able to analyse students' arguments, c) run on the web and thus do not require software installations on the user side, and d) are open source," McLaren elaborates. "Our goal was to develop a system that provided all of these capabilities".

DEVELOPMENT OF THE SYSTEM

The initial funding phase of LASAD, from 2008-10, involved a comprehensive review of the existing approaches to creating argumentation support systems. Over 50 systems were analysed and characterised using key categories, such as the way in which arguments were represented, the components used to construct them (ontologies) and the types of analysis and/or feedback available. The research went beyond merely studying publications on the systems: "We were in contact with a community of approximately 100 international researchers in the fields of education and argumentation," Pinkwart recalls. "We conducted a web-based questionnaire which was needed for the collection of requirements for a truly domain independent educational argumentation support system".

Based on feedback received from researchers in the field, the LASAD team identified key issues that needed to be addressed when developing their own system, such as the flexibility and interoperability of the system, and the opportunities to use it for collaborative work. This work was used as the basis for the design of the LASAD system. The defining feature of the LASAD design is its three-tier structure. The top tier is the user interface, designed for use on web browsers, but also includes an analysis and feedback client which allows for different analysis techniques to be implemented. The second layer is the server, with an interface that appears identical regardless of the client using it and thus provides interoperability, while the final layer is the database layer, which lends flexibility to the system with a wide range of configurable options (such as different argumentation languages for different domains) for system authors.

The analysis and feedback client is a very useful achievement in that it is capable of providing automated analysis of the argumentation activities of student users. Additionally, the client is able to provide tutorial-style feedback to individual students. The analysis and feedback client allows a variety of analysis agents to be 'plugged in' to the system depending on what is desired or deemed relevant. Action agents are also able to analyse student activity and provide feedback in retrospect or in real time (for example, if a student were to start deviating from the topic of discussion). Another useful tool built in at this stage was a range of domain-specific application scenarios to choose from – such as general, scientific, legal and classroom-



INTELLIGENCE

LASAD

LEARNING TO ARGUE: GENERALIZED SUPPORT ACROSS DOMAINS

OBJECTIVES

The project's aim is to create and test a generalised methodology for the construction of argumentation support systems to help students learn argumentation in different domains. This involves the research of a reusable ontology of argumentation learning objects and a large set of visual, analytic and pedagogic components that can be combined.

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PROFESSOR NIELS PINKWART holds a full professorship in Computer Science at Humboldt-Universität zu Berlin. Previously, he held positions at the University of Duisburg-Essen, at CMU and at Clausthal University of Technology.

DR BRUCE M MCLAREN is a senior systems scientist at Carnegie Mellon University. He has published over 100 scientific articles in journals, conferences and workshops. He received his PhD at the University of Pittsburgh in 1999.

Argumentation plays an important role in a variety of disciplines, including the law, politics, science and ethics, to name but a few

based arguments – with configurations and components already set up and customised for each chosen scenario.

REACHING A WIDER AUDIENCE

The second period of funding of the LASAD project, from 2010-12, has resulted in further strides for the two research groups and their system. Further user configurations and roles were added to extend the breadth of domains over which the framework can be applied to. The system was enhanced to provide even further interoperability, configuration and extension, in line with the fundamental objective of LASAD, to provide a truly general-purpose system. Finally, seven carefully designed studies were carried out, across a range of disciplines (eg. science, mathematics, the law, etc.), to assess the generality, stability and usefulness of the software. The success of these steps has put LASAD in a strong position towards general use for argumentation and its study.

Other educational technologies for argumentation do exist and are in use; however, McLaren is confident of the advantages

LASAD provides over its predecessors: "A unique feature of the LASAD system is that it enables the specification of argument analysis and feedback components which allow for inspecting student created arguments and providing instructional feedback when appropriate". However, he stresses that LASAD has not been created to enter into commercial competition with existing technologies; rather, it has been developed as an aid to research and learning that is accessible to as wide an audience as possible. He explains: "We did not develop LASAD with the intention of commercialising it. We wanted to provide a tool that many of our fellow researchers could use to conduct their research projects. Open source software is a great way to do that".

With its flexibility and ease of use across domains and operating systems, its intelligent analysis and feedback capability, and essential modern online features such as chat availability, LASAD is positioned to be a valuable tool for both researchers and students of argumentation. No matter what the discipline, the importance of a well constructed argument can never be underestimated.

