

# Modelling natural argumentation in education: Bridging traditional frameworks and modern multi-modal approaches

Loris Isabettini

*University of Windsor, 401 Sunset Ave, Windsor, Canada*

## Abstract

This paper explores the integration of multi-modal argumentation in educational contexts, drawing on traditional argumentation theories and contemporary methods to create a more inclusive and engaging framework. By incorporating verbal, visual, auditory, and experiential elements, the study aims to bridge the gap between classical argumentative structures and the diverse, real-world ways students and educators interact with arguments. Using both qualitative and quantitative approaches, the research highlights the importance of adapting argumentative practices to better suit modern educational needs. This study also examines the potential of computational tools in enhancing argument analysis, ultimately contributing to the development of more flexible and effective argumentation models across various educational settings.

## Keywords

multi-modal argumentation, educational contexts, qualitative and quantitative approaches, computational tools in argument analysis

## 1. Introduction

The modelling of “natural” argumentation, which encompasses the diverse forms and practices people use to present and evaluate arguments in educational contexts, is a critical area of study within argumentation theory. Natural argumentation in education extends beyond purely logical or structured arguments found in formal debates, reflecting the nuanced, dynamic, and often multi-modal ways in which students and educators communicate. This includes the use of visual aids, multimedia, rhetorical devices, and emotional appeals to influence and persuade learners (Schwarz & Baker, 2017). Understanding natural argumentation in education is crucial for gaining insights into how students reason and communicate in real-world settings.

The significance of modelling natural argumentation in education lies in its ability to bridge the gap between traditional argumentation frameworks and the diverse, context-dependent ways

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✉ [isabett@uwindsor.ca](mailto:isabett@uwindsor.ca) (L. Isabettini)

ORCID [0000-0002-9366-4863](https://orcid.org/0000-0002-9366-4863) (L. Isabettini)



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arguments are made and understood in practice. The integration of computational argumentation has further expanded the scope and applicability of natural argumentation models in education. Computational techniques, such as argumentation mining and automated reasoning, enable the analysis and generation of arguments on a scale and level of detail that was previously unattainable (Jiménez-Aleixandre & Erduran, 2007). These technologies facilitate the development of tools that can assist in tasks ranging from developing critical thinking skills to enhancing classroom discussions and collaborative learning (Osborne, 2005).

Using qualitative and quantitative approaches, my research highlights the importance of multi-modal elements—such as visual and auditory aids—in improving the clarity and effectiveness of arguments. The proposed findings will contribute to developing more robust argumentative frameworks applicable across diverse educational settings, offering valuable insights for advancing argumentation theory and its practical applications in pedagogy. I explore the interplay between academic and general argumentation practices, identifying unique features and commonalities that can inform more robust and flexible models. By leveraging both classical argumentation theories and modern multi-modal approaches, this research aims to advance argumentation theory and its practical applications in educational contexts.

## **2. Multi-modal argumentation: A brief synopsis**

Michael Gilbert's (1994) concept of multi-modal argumentation expands traditional frameworks by incorporating verbal, visual, auditory, and non-sensory modes, acknowledging that human cognition involves emotions, intuition, and sensory experiences alongside logical reasoning. This approach addresses the limitations of purely verbal and logical argumentation by enabling communication through diverse modes, making arguments more accessible and engaging. For instance, visual elements like infographics and auditory cues such as tone of voice can effectively convey complex ideas and evoke emotional responses, thereby enhancing the persuasive power of arguments. Similarly, Leo Groarke's (2015) analysis of multimodal argumentation (sans the hyphen) in political cartoons, which strategically blends visual and verbal elements to influence public perception, further supports the relevance of multi-modal strategies in educational settings. By integrating these approaches, educators can create more inclusive learning environments catering to diverse cognitive styles, enhancing students' ability to assess and craft persuasive arguments across various media critically.

## **3. Overview of key research in the area of argumentative practices in education**

Research on argumentative practices in education has evolved significantly, underscoring the importance of argumentation in fostering critical thinking, enhancing communication skills, and

promoting deeper understanding among students. Key studies by scholars such as Deanna Kuhn, Richard Andrews, and Paul Stapleton have emphasized the role of argumentation in developing students' reasoning abilities and preparing them for active participation in democratic society. Kuhn's work focuses on the developmental aspects of argumentative reasoning, showing that engaging students in argumentative discourse from an early age significantly enhances their cognitive and metacognitive skills. Her research demonstrates that students who participate in structured argumentative activities show improved abilities to construct, analyze, and evaluate arguments. Andrews has revealed that incorporating argumentative practices into subjects like science, history, and language arts leads to better learning outcomes and a more holistic educational experience. Stapleton's research highlights the practical applications of argumentation in the classroom, emphasizing the use of debate, peer review, and collaborative learning as effective strategies for promoting argumentative skills (Kuhn, 2010; Andrews, 2005; Stapleton, 2010).

Despite significant progress in understanding argumentative practices in education, several gaps remain. One notable gap is the lack of comprehensive models that integrate multi-modal argumentation within educational contexts. While traditional argumentation models primarily focus on verbal and written discourse, there is a growing recognition of the importance of incorporating visual, auditory, and experiential elements to reflect the diverse ways students engage with and understand arguments. Rapanta and Macagno (2016) discuss the need for more systematic discussions between argumentation theory and educational practice to address this gap. Additionally, more research is needed on the impact of computational tools in supporting argumentative practices in education. While some studies have begun to explore the potential of technologies such as argumentation mining and automated feedback systems (see Sadler, 2006), more work is needed to understand their effectiveness and how they can be best integrated into educational settings.

The significance of this study within the context of the Workshop on Computational Models of Natural Argument (CMNA) lies in its potential to bridge the gap between traditional and modern approaches to argumentation in education. By focusing on the specialist education domain, my work aims to develop comprehensive models incorporating multi-modal elements and leveraging computational tools to enhance argumentative practices.

#### **4. Research objectives and contributions**

##### **1. Identify and Analyze Domain-Specific Features:**

- Examine the use of Socratic dialogue in classrooms, which facilitates critical thinking by encouraging students to ask and answer questions that stimulate deeper

understanding. Compare this with structured argumentation schemes like the Toulmin model (1958) to see how each approach facilitates learning.

2. Compare Educational Argumentation with Other Domains:

- Investigate how the use of evidence in science classrooms compares to its use in legal education. In both cases, students learn to construct and evaluate arguments based on empirical data, but the contexts and applications differ significantly. Understanding these differences and similarities can inform better teaching practices in both domains (Osborne, 2005; Jiménez-Aleixandre & Erduran, 2007).

3. Inform Broader Argumentation Models:

- Use insights from analyzing debate formats in high school education to inform the development of argumentation models that can be applied in public policy discussions. For instance, the structured format of debates in education could be adapted to create more effective public forums for policy deliberation.

4. Integrate Classical and Modern Approaches:

- Analyze how traditional rhetoric, such as Aristotle's ethos, pathos, and logos, can be integrated with modern multi-modal elements like visual aids and digital media used in educational settings. Develop an approach combining these classical rhetorical strategies with contemporary practices to enhance argumentation in academic and professional contexts.

To gain a deep understanding of how arguments are made and understood in educational settings, the study will collect and analyze data from various sources, including classroom discussions, debates, written assignments, and multimedia presentations. Through content analysis, key elements such as dialogue patterns, rhetorical devices, and linguistic cues will be identified. Interviews with educators and students will provide further insights into their experiences and perceptions, allowing for a more nuanced understanding of argumentative practices.

The study also includes a comparative analysis of argumentation in different domains, using computational tools to analyze large datasets of discourse. These tools will help identify patterns and trends, ensuring that the findings are both theoretically sound and practically relevant. The goal is to develop a comprehensive model that captures argumentation's dynamic and multi-faceted nature in education while being adaptable to various educational contexts. Throughout this process, the emphasis will be on understanding the lived experiences of students and educators rather than imposing a rigid analytical structure. By staying open to the complexities and subtleties of argumentative practices, this approach aims to create a framework that is both inclusive and reflective of the diverse ways in which people engage with arguments.

## **5. Justification for the chosen approach**

The mixed-methods approach captures the complexity of natural argumentation in education. Qualitative methods provide deep, contextual understanding, while quantitative methods offer rigour and generalizability; the former uncovers nuances often missed by the latter. Through content analysis and interviews, the study explores the subtleties of dialogue, rhetorical strategies, and emotions in educational arguments. Computational tools leverage data analysis to identify patterns and trends, ensuring findings are theoretically sound and empirically robust. Combining classical theories with modern computational techniques bridges traditional and contemporary approaches, making the research comprehensive and relevant. The reason for comparing Socratic dialogue with the Toulmin model, for instance, lies in understanding how different traditional frameworks facilitate learning and argumentation in educational settings. Socratic dialogue encourages interactive and reflective thinking, whereas the Toulmin model provides a structured approach to constructing arguments.

## **6. Description of computational models and frameworks used**

Several computational models and frameworks are employed to analyze and simulate argumentative practices. Argumentation mining tools, like Araucaria and OVA+, automatically identify and extract argumentative structures from data (Thimm & Villata, 2017). Automated reasoning systems, such as Carneades and Rationale, simulate argumentation scenarios and evaluate argumentative strategies (van Gijzel & Prakken, 2012). Multi-modal analysis frameworks integrate visual, auditory, and textual elements of arguments. Tools like Kress and van Leeuwen's Grammar of Visual Design help us understand how visual elements contribute to argument persuasiveness (El Baff et al., 2019). Comparative analysis software, like NVivo and MAXQDA, supports qualitative comparative analysis, facilitating systematic comparison across domains (Gkotsis & Karacapilidis, 2012). These tools aid in coding, categorizing, and identifying commonalities and differences in argumentative features.

## **7. Future directions**

This study highlights the potential of integrating multi-modal elements into argumentation models to enhance educational practices. While the methods employed offer valuable insights, the study's scope is limited by its focus on specific educational settings, which may not fully capture the diversity of argumentative practices across different institutions and cultures. The reliance on qualitative analysis may also limit the generalizability of findings, and the computational tools used, though innovative, require further validation.

Future research should broaden the data collection to include more diverse educational contexts and incorporate extensive quantitative data to strengthen empirical support.

Additionally, refining and validating computational tools for argumentation mining and analysis is essential, particularly in light of discussions at recent Intelligent Learning Society (ILS) meetings, which emphasize the role of AI and adaptive learning technologies in education. Incorporating these emerging technologies will be crucial for advancing argumentation practices in a rapidly evolving educational landscape.

In conclusion, the integration of multi-modal elements into argumentation models represents a significant advancement in making arguments more accessible, engaging, and effective. As research in this area progresses, expanding the scope, validating tools, and embracing new technologies will be essential to preparing students for the complex and diverse discourse of contemporary society.

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