Texto 1

Analytic Frameworks for Assessing Dialogic Argumentation in OInline Learning Environments

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Formal Argumentation Structure

Formal argumentation structure provides a common and reasonable focus for analytic methods as well as pedagogical approaches that are designed to foster argumentation. Toulmin's *The Uses of Argument* (1958) is probably the most heavily cited method for the assessment of argumentation in general and certainly the most heavily cited in terms of formal argumentation structure (within technology-enhanced learning environments or without). We therefore begin with Toulmin even though his framework focuses neither specifically on dialogic argumentation nor on technology-based environments. We then discuss Erduran, Simon and Osborne's (2004; Osborne, Erduran, and Simon, 2004) adaptation of this approach to the analysis of students' dialogic argumentation.

Toulmin: A Core Foundation for Argumentation Structure

Toulmin's framework suggests that the components of an argument have different functions that can be classified into one of six categories: Claims (assertions about what exists or what values people hold), Data (statements that are used as evidence to support the claim), Warrants (statements that explain the relationship of the data to the claim), Qualifiers (special conditions under which the claim holds true), Backings (underlying assumptions), and Rebuttals (statements that contradict either the data, warrants, or backings of an argument). Toulmin describes the process of argumentation primarily as a process of using data, warrants and backings to convince others of the validity of a specific claim (Figure 1). From this perspective, the strength of an argument is based on the presence or absence of these different structural components. Stronger arguments contain more of these different components than weaker arguments. Toulmin indicates (1) that context determines which components are necessary in a given situation and (2) that field-dependent criteria determine the quality of each component. Analyses of argumentation using Toulmin's argument model have primarily examined how students provide data and warrants for claims, when they do, and on what basis.

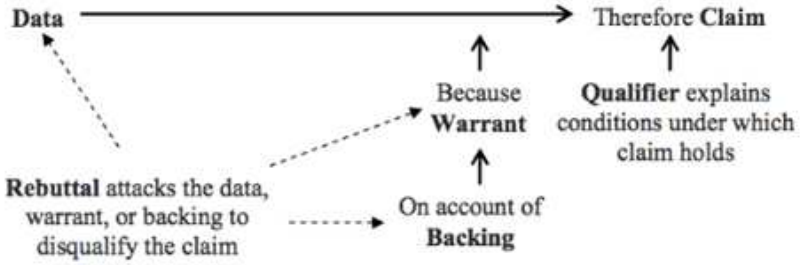

Figure 1: Toulmin's model of an argument

The application of Toulmin's framework to our student example therefore focuses primarily on the inclusion of warrants, data, and backings to support claims. Toulmin does not provide specific criteria for categorizing ongoing dialog or content quality. Instead, dialogic argumentation can be analyzed with Toulmin's argument components by interpreting components in the context of the components to which they refer. A backing, for example, can be interpreted as a claim for yet another argument. Similarly, a rebuttal can be interpreted as a counter-claim (Voss & van Dyke, 2001). Based on the categories provided by Toulmin, the students in our example provide warrants and data for their claims (as labeled in Table 1 below). The students therefore seem to be engaging in reasonably high-quality argumentation.

Table 1: Application of Toulmin's (1958) framework to example argumentation

Fran:	I think objects in the same room remain different temperatures [CLAIM] because some objects are good conductors and some are bad [DATA]. This determines how much heat energy is allowed in and out of the object [WARRANT].
Amy:	I disagree; I think all objects in the same room are the same temperature [COUNTER-CLAIM]. Conductivity only determines how quickly an object will reach room temperature [WARRANT].
Fran:	No, good conductors let in more heat energy than poor conductors, so objects that let in more heat will get hotter [REBUTTAL]. For example, when I put a piece of metal and a piece of plastic in hot water the metal was a higher temperature after 30 seconds [DATA].
Amy:	I guess you're right. Maybe objects are different temperatures.

Erduran, Simon, and Osborne: Adapting Toulmin to Dialogic Argumentation in the Classroom

Erduran, Simon, and Osborne (2004, Osborne, Erduran, and Simon, 2004) apply Toulmin's model as a way to identify the salient features of argumentation during small group and whole class discourse. Erduran, Simon, and Osborne characterize the argumentative operations that occur during dialog that is oppositional in nature. These argumentative operations include: (a) opposing a claim, (b) elaborating on a claim, (c) reinforcing a claim with additional data and/or warrants, (d) advancing claims, and (e) adding qualifications.

After identifying the argumentative operations, the quality of the argumentation that takes place during these episodes is assessed using the hierarchy outlined in Table 2. This hierarchy is based on two major assumptions about what counts as quality as defined by Erduran, Simon, and Osborne. First, high quality arguments must contain grounds (i.e., data, warrants, or backing) to substantiate a claim because "developing rational thought is reliant on the ability to justify and defend one's beliefs" (Erduran et al., 2004, p. 926) and argumentation that does not contain any justification "is essentially a discursive interaction incapable of any resolution" (Erduran et al., 2004, p. 926). Second, argumentation that include rebuttals is "of better quality than those without, because oppositional episodes without rebuttals have the potential to continue forever with no change of mind or evaluation of the quality of the substance of an argument" (Erduran et al., 2004, p. 927).

Table 2: Dialogic argumentation hierarchy developed by Erduran, Simon, and Osborne (2004)

Quality	Characteristics of Argumentation
Level 5	Extended arguments with more than one rebuttal.
Level 4	Arguments with a claim with a clearly identifiable rebuttal. Such an argument may have several claims and counterclaims as well, but this is not necessary.
Level 3	Arguments with a series of claims or counterclaims with data, warrants, or backings with the occasional weak rebuttal.
Level 2	Arguments consisting of claims with data, warrants, or backings, but do not contain any rebuttals.
Level 1	Arguments that are a simple claim versus a counterclaim or a claim versus claim.

Erduran, Simon, and Osborne's analytic framework assesses the individual elements of our student example quite similarly to Toulmin's approach (Table 1). One difference involves collapsing the data, warrant, and backing category into a single "grounds" category due to the practical challenges of distinguishing between data, warrants, and backings in student work. Overall, the student example would be considered a Level 4 argument according to Erduran, Simon, and Osborne's hierarchy of dialogic argumentation outlined in Table 2 because the argumentation includes a clearly identifiable rebuttal against the grounds of an opposing claim. The example would therefore represent fairly high quality argumentation from the perspective of this framework.

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Texto 2

History of Mathematics and History of Science Reunited?

Jeremy Gray

Abstract

For some years now, the history of modern mathematics and the history of modern science have developed independently. A step toward a reunification that would benefit both disciplines could come about through a revived appreciation of mathematical practice. Detailed studies of what mathematicians actually do, whether local or broadly based, have often led in recent work to examinations of the social, cultural, and national contexts, and more can be done.

HOW TO WRITE THE HISTORY OF MODERN MATHEMATICS?

This question, in itself no harder or less capable of an answer than the broader question of how to write the history of modern science, should be part of that broader question, but it has become separated. Recent initiatives, however, suggest that these questions can once again be raised and discussed together. There are in each case several fundamental latent issues. The question of how we should do something invites us to consider who "we" are and for whom we are doing it. I duck the first of these considerations and note that different audiences want different things from the history of science and the history of mathematics, so this essay will necessarily have to make some uncomfortable compromises. The same is true of the words "modern" and "mathematics." I shall restrict my attention to the mathematics of the long nineteenth and short twentieth centuries and, further, to the activities of professional mathematicians, because this is where the separation between historians of mathematics and of science has become greatest and where, perforce, some of the most innovative work has been done. The secret history that George Sarton referred to so many years ago is buried most deeply here and must be brought out.

The audience question is itself multifaceted. The disciplinary divide works differently in mathematics and in science, and there is nothing like the separation in the development of mathematics that the theories of general relativity and quantum mechanics create in physics. Indeed, much of today's undergraduate mathematics syllabus is the creation of nineteenth-century mathematicians. So one audience for the history of modern mathematics, quite rightly, is professional mathematicians. Inevitably, these people have expectations that historians of science do not, and the compromises authors make when writing for an audience of mathematicians has disadvantaged them when writing for the second group. But this is a smaller matter than it has been allowed to appear. Every act of writing, every piece of research, is a series of compromises: with the sources, with one's own skills (linguistic, financial, and so forth), with one's knowledge of other fields (social, historical, political, philosophical-the list is only too long). The only way we have as historians of coping with all these demands is the collective nature of our work and the possibility of relying on the knowledge of others. If, from a certain perspective, all a lengthy technical history of a piece of modern mathematics does is to establish that a particular mathematician spoke with well-grounded authority, then that might be enough. Better that such a claim be established than that it be taken on trust, because in mathematics, as in the rest of science, authority is only partial, dynamic, and contested.

The challenge posed to historians of modern mathematics by contemporary history of science is to move away from a worn-out mode of history of ideas, a challenge exacerbated by the highly specialized nature of the ideas themselves. This challenge exists in several forms. There are those who see big themes in the history of science, such as mechanical objectivity, and there are advocates of highly localized studies (one site over a fairly short period of time). There are those who would finesse the difficult technical material and those (perhaps a smaller number these days) who would savor its variety. There are those who would have us see "real people" in all their historical contingency. But perhaps the dominant pressure is to move the history of science away from an intense focus on scientific ideas and on to the integration

of science in society: its uses, its costs, its political implications. None of this is easy. It is not impossible, for example, to write a biography of a scientist that integrates the person and his or her times, but the very fact that it is a commonplace in the criticism of biographies of poets and novelists that the links between "life" and "works" are less than one would like can surely stand as a sign that it will be much harder to anchor a modern mathematician in his or her context and, still more, that it will be difficult to "explain" much about him or her. See Joan Richards's account of how this can be done in the happy case of Augustus De Morgan in this Focus section.

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Responda às questões 1 a 3 a seguir, com base no texto 1 dado.

O primeiro texto é um excerto de um artigo que discute referenciais analíticos para investigar argumentação dialógica em ambientes online.

Questão 1. Faça a tradução para o português do parágrafo introdutório do excerto escolhido no primeiro texto (trecho com o subtítulo *Formal Argumentation Structure*).

Questão 2. Enuncie e descreva as seis categorias do modelo de Toulmin.

Questão 3. Quais as modificações trazidas por Erduran, Simon e Osborne (2004, Osborne, Erduran and Simon, 2004) e quais os motivos dos autores para concebê-las?

Responda às questões 4 e 5 a seguir, com base no texto 2 dado.

Questão 4. Em o que consiste a diferença entre os públicos para quem os historiadores da matemática e os historiadores da ciência escrevem? Quais consequências para as respectivas pesquisas têm essas diferenças em se dirigir ao seu público?

Questão 5. Que desafios vê o autor para o historiador da matemática moderna e que diferentes abordagens ele propõe para enfrentar o desafio? Qual ele enfatiza particularmente?