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What Is Meant by Argumentative Competence? An Integrative Review of Methods of Analysis and Assessment in Education

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What Is Meant by Argumentative Competence? An Integrative Review of Methods of

Analysis and Assessment in Education

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Abstract

The need to enhance argument skills through education has become increasingly evident during the last 20 years. This need has resulted in an ongoing discussion that focuses on students' and teachers' argumentation, and its support. However, apart from the extended competence-based discourse, no clear and homogeneous definition exists for argumentative competence and its constituent skills. To respond to this deficiency, we conducted an integrative literature review focusing on the methods of argument analysis and assessment that have been proposed thus far in the field of education. Specifically, we constructed an interpretative framework to organize the information contained in 97 reviewed studies in a coherent and meaningful way. The main result of the framework's application is the emergence of three levels of argumentative competence, namely, metacognitive, metastrategic, and epistemological competence. We consider this result the beginning of further research on the psycho-pedagogical nature of argument skills and their manifestation as competent performance.

Keywords: argumentation, competence, review, argument analysis, argument assessment

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The Role of Argumentation in Education

Argumentation is generally defined as the valid combination between claims and premises (Plantin, 1996), which in education is highly related to high-quality teaching and learning. As Cox and Willard (1982) put it, "argument can be seen as a method of knowledge… [and] arguments in differing ways produce knowledge" (pp. xiii). Thus argumentation is one of the mostly discussed competences in the educational field, due to its proven relationship with critical and higher order thinking. More concretely, argumentation increases the complexity of knowledge (Venville & Dawson, 2010), the use the students make of this knowledge (Jimenez-Aleixandre & Pereiro-Muñoz, 2002; Zohar & Nemet, 2002), and the critical revision of it (Cross, Taasoobshirazi, Hendricks, & Hickey, 2008), which comes along, hand in hand, with the quality of reasoning involved (Kuhn, 1991) resulting in general educational gains. Higher order thinking is ultimately defined as the metacognitive control of the differentiation and coordination of theory and evidence (Kuhn, 1989). Kuhn further establishes that it is the desire for knowledge understanding that drives the process of coordinating theory and evidence with this intentional knowledge seeking being what would lead to learning (Kuhn, 1991, 2005). Thus, argumentation seems to provide opportunities for students to refine their understanding of the content, prompting them to sort relevant from irrelevant information, make connections across contexts and increase the explanatory power of their knowledge.

For the reasons described above, argumentation seems to play a major role in education in both American and European settings. Most US universities require students to pass two first-year composition (FYC) courses that partly aim to teach the basics of a certain conception of "college-level argumentation" (Andrews, 2009). In the American National Science Education standards, argumentation appears among the main requirements of

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scientific inquiry for grades 5 to 12 (NRC, 2000). In the European Parliament's recommendation on key competences for lifelong learning (EU, 2006), argumentation appears to be linked to 3 of the 8 key competences set out by the reference framework, namely, a) communication in the mother tongue, b) mathematical competence and basic competences in science and technology, and c) learning to learn. This recommendation has influenced the introduction of argumentation in many European countries' policy documents (see the S-TEAM 2010 project report for an overview).

However, it is not yet clear what exactly is meant by the term "argumentative competence" (Trapp, Yingling, & Wanner, 1987), and what is actually being fostered through all these policies affecting both students and teachers at different educational levels. To find the answer, one could possibly draw back to the ancestor of argumentation, which defines its very nature. We refer to the Informal Logic movement, born in North American universities in the late 1970s (Johnson, 2000). In contrast to at the time prevalent Formal Logic, which was exclusively based on deductive syllogisms, the more recent Informal Logic current recognizes at least three types of inferences, namely deductive, inductive, and plausible or abductive arguments (Walton, 1989). Table 1 presents the same example of inference expressed with each one of the three reasoning modes. Given the observable resemblance of the inductive inference with the scientific argument, and of the abductive reasoning with most everyday arguments, Informal Logic has gradually become the predominant way of treating argumentation in schools. Nonetheless, the quality or even the validity of Informal Logic, especially of the inductive and abductive types, is still questionable and depends on criteria, which are not always easy to reveal.

Problem Statement: Toward a Definition of Argumentative Competence

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Many definitions of argumentation have been provided to date. The most general and inclusive definition considers argumentation as "a verbal, social, and rational activity aimed at convincing a reasonable critic of the acceptability of a standpoint by putting forward a constellation of one or more propositions to justify this standpoint" (van Eemeren, Grootendorst, & Snoeck Henkemans, 2002, xii). Additionally, a distinction is made between argument and argumentation, which is also known as argument-as-product and argument-as-process (Johnson, 2000; Kuhn & Franklin, 2006), or as argument1 and argument2 types (O'Keefe, 1982). Johnson (2000) indicates the complexity of the practice of argumentation by stating that it is composed of three elements, namely, the product-argument, the process-arguing, and the agents, i.e., the arguer and the other.

However the concept is viewed, difficulty in defining argumentative competence is evident due to the great variety and variability of factors it implies. This variety and variability also explain the range of perspectives offered in the study of argumentation, such as linguistic, dialogical, dialectical, pragmatic, and social perspectives. Such variety in approaches and methods renders it difficult and sometimes even confusing for an educational researcher or practitioner to provide a concrete definition of argumentative competence, and the "best" method to assess it. However, as stated in the introduction, most educational policies around the world request the enhancement of students' and teachers' argument skills. Although an argument-oriented policy is desired, the main obstacle to adopting such a policy is the lack of clear definitions of the skills to develop and their components. As Hample (2003) states, "in trying to understand why some people are better at arguing than others, and what may be performed to help those who are less skilled, I think that the most fundamental question to answer is, What do people think they are doing when they are arguing?" (p. 443).

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The goal of this paper is to offer an integrative account of what is meant by the term "argumentative competence". Following Hample's (2003) line of thinking, this study's motivating question is "What do researchers assess when they say that they analyze and evaluate argument skills?" We believe that the most appropriate field to address this question is the broader field of education, given that the assessment of argument skills is mainly a psycho-pedagogical issue. Moreover, we are not interested in argumentation as a natural ability composed of skills that emerge with age. Instead, we focus on those aspects of skilled argumentation that, first, do not emerge spontaneously but as a result of some other factor that accompanies age and, second, are of interest to the field of education, primarily because they can be improved by instructional means.

The structure of this paper is as follows: first, an overview of the main theoretical perspectives of argumentation in relation to education will be provided; next, an interpretative coding framework based on the relevant literature will be proposed as the main data analysis method; and finally, the application of this framework will be offered as proof of the reliability of our conceptual proposal, and will seek to facilitate new considerations in the ill-defined field of argument evaluation in education (henceforth, the terms "argument" and "argumentation" will be used interchangeably throughout the article).

Perspectives on Argumentation in Education

Undoubtedly, argumentation is of increasing interest in education, for the reasons previously described. In general, two main tendencies can be observed: the "arguing to learn" approach (e.g., Aufschnaiter, Erduran, Osborne, & Simon, 2008; Andriessen, Baker, & Suthers, 2003; Zohar & Nemet, 2002; Jiménez-Aleixandre & Pereiro-Muñoz 2002) in which conceptual understanding and learning emerge as natural result of an argumentative

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intervention; and the "learning to argue" approach (e.g., Kelly, Drucker, & Chen, 1998; Reznitskaya, Anderson, McNurlen, Nguyen-Jahiel, Archodidou, & Kim, 2001; Osborne, Erduran, & Simon, 2004; Kuhn, 2005) which focuses on argumentation per se and on its educational benefits, especially in the limits of a specific curriculum context. Both tendencies have been broadly used in educational research, confirming either the one or the other direction. Under this general theoretical umbrella, several research perspectives on argument in education have been developed thus far, such as: the science education perspective, the computer-mediated education perspective, and a more general psycho-pedagogical view. Some main elements regarding each one of these will be discussed in this section.

Starting from science educators, their increased interest in argumentation originates in the shift that occurred in recent decades from understanding science as true uncontested facts to its current conceptualization as knowledge formed by provisional theories likely to be modified as new disconfirming data are generated. This shift is illustrated by the four goals of Duschl, Schweingruber, and Shouse (2007) for becoming proficient in science: knowledge of scientific explanations of the natural world, generating and evaluating scientific evidence and explanations, understanding the epistemic nature of scientific knowledge, and participating in scientific practices and discourse. Close examination of each goal shows that argumentation underlies all four more or less explicitly, which might explain why argumentation has become so present in science education in recent decades. Scholars who study the first goal focus on argumentation as a means to learn science (Hennessey, 2003; Nussbaum & Sinatra, 2003; Nussbaum, Sinatra, & Poliquin, 2008; Zohar & Nemet, 2002). Therefore, these scholars' research focuses on analyzing how classroom argumentation practice leads to learning science concepts and conceptual

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change. Scholars who focus on the second goal address argumentation as a core process of scientific thinking. From a developmental psychology perspective, D. Kuhn (1989) defines scientific thinking as the coordination of theory and evidence in which argumentation functions as a link between data and scientific theories. Thus, the analysis focuses on how evidence is generated and interpreted, processes that establish the basis for argumentation (Kuhn, 2002; Lehrer & Schauble, 2002; Osborne, Erduran, & Simon, 2004). A focus on argumentation as an epistemological practice defines the research developed by those who emphasize the importance of the third goal and argue that understanding how science is formulated is essential for proper thinking and learning (Jimenez-Aleixandre, Bugallo-Rodriguez, & Duschl, 2000; see also the review by Sadler, 2004). Thus, science students require assistance to understand the epistemic nature of science knowledge, and argumentation is implicit in this understanding. Finally, researchers who believe that learning science implies the appropriation of scientific practices and discourse conceptualize "science as argument" and focus on argumentation as a goal and central activity in science classrooms (Erduran & Jimenez-Aleixandre, 2008; Kuhn, 1991, 2010; Driver, Newton, & Osborne, 1998).

Not necessarily connected to scientific issues or to science classrooms, the use of computer tools to mediate argumentation practice in schools is another recent development. Specifically, argumentation is treated as a desired and expected outcome of interventions related to the use of computer tools. Most authors adopting this perspective form part of a broader community, namely, Computer-Supported Collaborative Learning (CSCL). The main goal of CSCL studies focusing on argumentation is either to shed light on how computer-based interventions lead to specific changes in argumentative activities, or to evaluate argumentative activities through a practice supported by an electronic tool

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(Andriessen, et al.). In other words, "CSCL researchers have focused on (1) how argumentation can be exploited as a site for learning generally and (2) how learning accomplished in this way might be augmented using technology" (Koschmann, 2003; p. 261). The first focus refers to the theorized (Baker, 1999) or proven (Asterhan & Schwarz, 2009) relationship between argumentation practice and conceptual change mainly because through argumentation, meanings are negotiated, solutions are co-constructed, and the epistemic status of the concepts treated is changed (Baker, 2003, 2009). The second focus refers in a more experimental sense to the relation between the type of tool or intervention and argumentative outcomes, in other words, to the success of certain CSCL systems used to date to support argumentation. Some of them are (Scheuer, Loll, Pinkwart, & McLaren, 2010): argumentation systems, argument representations, interaction design, ontologies, automated analysis, tutorial feedback, and general software architecture.

Finally, a more general tendency from the educational or developmental psychology field is noted. A common focus of these various studies is the relationship between cognitive or epistemological development and argumentation. This connection has been analyzed by developmental psychologists as the combination of intra- and inter-psychological processes that develop with age through practice (Garcia-Mila & Andersen, 2008; Muller Mirza, Perret-Clermont, Tartas, & Iannacone, 2009). From a young age, children seem to be able to construct arguments, counter-arguments, and even to refute others (Stein & Miller, 1991), but "true" consideration of the other party and the development of elaborated counter-arguments and rebuttals are much later achievements (Golder, 1993; Kuhn, 1991). In other words, the ability to argue is a natural, human, cognitive performance, but its skilled or competent expression is not spontaneous, which is why education is an important factor in its activation. As Schwarz (2009) states, "since

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students acquire basic argumentative skills very early, what is more needed is to contextualize these skills in educational settings" (p. 95). Thus, most educational efforts oriented towards "learning to argue" include this contextualization as a main condition in order to enhance understanding or construction of specific knowledge.

However, efforts focusing on "arguing to learn" are not necessarily related to a concrete curriculum. Based on Vygotsky (1978), who claims that knowledge exists as a social entity rather than an individual entity, knowledge construction becomes clearly scaffolded by classroom discourse and, within such discourse, by argumentative dialogue. In this general psycho-pedagogical view, argumentation is scaffolded for various reasons: because it is a way of constructing specific knowledge (Baker, 1999; Schwarz, 2009), because of its strong relationship to individuals' epistemological beliefs (Weinstock, Neuman, & Glassner, 2006; Weinstock, 2006), because it seems that argumentation is related to some informal reasoning mechanism that only becomes activated through the practice of argument (Means & Voss, 1996; Reznitskaya, et al., 2001), because of its connection to critical thinking (Kuhn, 2005), and finally because people seem to learn "better" when they argue (Baker, 2003; Leitao, 2000; Nussbaum & Sinatra, 2003).

Towards Defining Argumentative Competence

When discussing argumentative competence, we mainly refer to the ways in which different types of skills related to argumentation are manifested in a person's performance in both monological (individual) and dialogical (peer-to-peer) contexts. Therefore, to understand argumentative competence, we must understand how argumentation is actually performed by the target group participants. Argumentation is studied and understood mainly in two ways: first, through its analysis, and second, through its assessment or evaluation. As Johnson (2000) indicates, any theory of argument must be subdivided into

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two theories: a theory of analysis and a theory of appraisal. "The theory of analysis has the task of dealing with the questions concerning the nature, structure and typology of argument (…) The theory of appraisal has the task of coming up with the standards and criteria and types of evaluation and-or criticism" (Johnson, 2000: 40-41). Moreover, analysis must precede evaluation. As van Eemeren, Grootendorst, and Snoeck Henkemans (2002) claim, "the analysis of the argumentation is the point of departure for the evaluation" (p. xiii).

Nonetheless, both analytical and evaluative aspects of argumentative competence are considered problematic. Regarding analysis, the major problem is the choice of different existing focuses and approaches. How researchers perceive argumentation significantly defines their choice of analytical approach to argumentative competence. Regarding assessment, the situation is even more complicated, as researchers are faced with a twofold task: not only must they choose among aspects to focus on, but they also must ensure that the selected appraisal criteria are valid and reliable, meaning that they measure what they are supposed to measure in a repeatable and systematic way.

Focusing on educational researchers and their actual practices in evaluating the argumentation skills of students and/or teachers, we find two major difficulties. First, the adoption of a theoretical approach for argument does not directly reflect what is actually studied in argument-focused research in the field of education, mainly because argumentation assessment originated in the field of philosophy, and its specific assessment tools are hardly mastered by researchers from different fields. Second, the assessment of a complex performance such as argumentation requires focusing on the necessary metacognitive aspects implied in any higher order reasoning activity that has cognition as its object (Kuhn, 2000). This characteristic renders argumentation a metaknowing

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competence, involving different levels of skills. Kuhn and Pearsall (1998) identify two

types of metaknowing, one about declarative knowledge, i.e., metacognitive knowing, and

the other about procedural knowledge, i.e., metastrategic knowing. Situating participants in

one level or the other should be the goal and result of assessment. However, such objective

assessment regarding argumentation is not yet a reality given the polyvalence of methods

and criteria and the lack of a conceptual framework to guide reliable assessment.

In the following paragraphs, we present several basic common concepts among

researchers regarding the analysis and assessment of argumentative competence and several

initial classifications that serve this scope.

Analysis of Argumentation

To proceed to any type of argument analysis, one first must consider the tripartite

nature of argumentation. This structure involves at least three approaches, namely, logic,

dialectic, and rhetoric, as first proposed by Aristotelian philosophy and then expanded by

contemporary philosophers, such as Tindale (1999) and Vega Reñon (2003). As the former

scholar notes, "in several discussions of argumentation, the Aristotelian triad has been

identified with the three "p's" of product, procedure, and process" (Tindale, 1999, p. 3).

Viewing argument as a product, which is the basis of the logic perspective, implies the

main consideration that argument is a unit of reasoning in which one or more propositions,

i.e., the premises, are combined to support another proposition, i.e., the conclusion (Angell,

1964). Defining argument as a procedure calls for special attention to the dialogical aspects

of argument, such as the use of reasoning in a context (Walton, 1998). Finally, argument as

a process both involves and addresses the whole person and her context, i.e., taking into

consideration the particular circumstances in which the argument is used (Perelman, 1982).

To understand how these three main analytic approaches are implemented in

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educational research, we propose as units of analysis three main definitions of argument, namely, argument as a form, as a strategy, and as a goal.

Argument as form

Regarding form, the most influential proposal has been that of Toulmin (1958). In his well-known model of argument, a claim-conclusion is a statement whose merit must be established. This process is achieved mainly with the use of grounds or data and warrants, i.e., statements authorizing the movement from the grounds to the claim. Toulmin's main contribution is the proposal of warrant, which becomes explicit only when the argument is challenged or when the arguer considers it necessary to make her warrant(s) explicit. As Toulmin (1958, p. 98) states, "our task is no longer to strengthen the ground on which our argument is constructed, but is rather to show that, taking these data as a starting point, the step to the original claim or conclusion is an appropriate and legitimate one".

The function of "warrant" has been greatly appreciated in the field of education and especially in science education, a field in which what counts the most is not a mere statement of more or less evidenced knowledge but the connection between theory and evidence (Kuhn, Amsel, & O'Loughlin, 1988). This connection, also simply called "reasoning" (McNeill, 2008), is expressed by the use of warrants and backings. For Toulmin's Argument Pattern (TAP), a claim without grounds is not an argument, and an argument without a warrant is not a legitimate argument. Of course, such a view implies a notion of added quality to the basic claim-grounds argument structure. Other proposals from the field of education have been offered to add qualitative value to TAP elements (e.g., Erduran, Simon, & Osborne, 2004; Kelly, Regev, & Prothero, 2008).

Argument as strategy

In a dialogical context, argument as a strategic procedure is analyzed based on

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argument moves (Walton, 1998), which correspond to specific statements necessary for a dialogical contribution to be considered argumentative. The use and identification of these moves strongly depends on the dialogical context; therefore, several proposals for argument moves have been made. The basic rationale behind most of the proposals is elaborated by Kuhn (1991), who claimed that argument skills consist of constructing an argument, justifying an argument, constructing a counter-argument, and rebutting another's counter-argument. However, Kuhn's (1991) initial proposal applied to quasi-dialogical contexts (interviews) results in lacking elements that would normally be present in the dynamic process of on-going oral argumentation. Subsequent analytical coding schemes have been proposed for this reason, either by Kuhn and her colleagues (e.g., Felton & Kuhn, 2001; Felton, 2004) or by researchers in the field of CSCL (e.g., Andriessen, Erkens, van de Laak, Peters, & Coirier, 2003; De Vries, Lund, & Baker, 2002). In the latter case, argumentation is semi-oral (Marttunen & Laurinen, 2001), i.e., in the form of computer-mediated written dialogue. Among these moves, some refer to dialogue acts that are not argumentative themselves, but their presence is considered to be systematically related to argumentation; a number of these moves include acts of clarification (Baker, 2003; Clark & Sampson, 2008), explaining (De Vries, Lund, & Baker, 2002; Andriessen, Baker, & Suthers, 2003), or questioning (Asterhan & Schwarz, 2009; Berland & Reiser, 2011). Instead, other acts relate to the nature of an argumentative dialogue in contrast to other argumentation contexts, such as an interview or an essay, and more precisely to the co-constructive aspects of interaction (Baker, 1999). These acts are mainly of two types: acceptance acts, referring to any dialogical attempt to concede to or compromise with a different or contrary opinion, and revision acts, referring to any dialogical but not necessarily interpersonal attempt to arrive at an outcome or conclusion.

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Argument as goal

Finally, argument has also been viewed as an overall performance focusing on the specific goal and/or function it serves. According to this perspective, analysts are not as much interested in arguments as individual products, or in the procedure of argument exchange, but they rather focus on the whole discursive process (individual or peer-to-peer) as more or less argumentative according to criteria. The main criterion-goal of argumentation has traditionally been persuasion (Walton, 1989). This view has been proposed by the School of New Rhetoric (Perelman & Olbrechts-Tyteca, 1969) and more recently by the School of Pragmadialectics (van Eemeren & Grootendorst, 1992). Apart from the persuasion criteria and conditions proposed by each school, the latter additionally presents an "ideal" stage-model of persuasive argumentation called critical discussion (van Eemeren & Grootendorst, 2004). However, in such contexts as education, in which learning is the final goal of any activity, argumentation is more appropriately regarded as a cooperative or "win-win" rather than as a competitive or "win-lose" activity. Viewed as cooperation, argumentation's main goal is to negotiate contents to arrive at a consensus regarding the final epistemic state of these contents (Baker, 1999). Persuasion and negotiation are both expected to be the main goals of argumentation in educational contexts.

Assessment of Argumentation

However conceived, i.e. as form, as strategy, or as goal, informal argument assessment is based on the identification of those skills that individuals apply in order for certain argumentation products to emerge. Following Kuhn (1999, 2000a; 2000b), we perceive argumentation as a metaknowing competence. In our understanding, such meta-knowing is composed of three main types of knowing, namely, metacognitive, metastrategic, and

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epistemological knowing. Metacognitive knowing mainly refers to declarative knowledge, whereas metastrategic knowing refers to procedural knowledge. To these types of metaknowing, we add epistemological knowing, which involves knowing about knowledge in general and/or in relation to a person's knowledge. Translated into performance, the three types of knowing correspond to know-what, know-how, and know-be skills (Brown & Duguid, 2001).

Metacognitive assessment mode

In the case of argumentation, know-what skills are mostly related to the metacognitive aspects of knowing, meaning what one should know in order to construct valid informal arguments in educational contexts. The following know-what skills can be reflected in students' and teachers' argument performance.

- Structure: Arguments are mainly a composition of statements. Thus, how these statements are connected and how the elements of each statement are organized are the first relevant skills of argumentation.

- Conceptual quality: Argumentation is always about an issue. In educational contexts, this issue is usually connected to a specific subject. Moreover, researchers who adopt an "arguing to learn" approach are especially interested in how argumentation enhances conceptual understanding and learning, which becomes explicit through the conceptual quality of the discourse.

- Epistemic quality: Finally, arguments are logical products, and as such, some type of validity must be established. Of course, this validity cannot be assessed through the criteria of Formal Deductive Logic, as explained in the introduction. In informal logic, the connection between claims and premises is less

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straightforward and more plausible than in formal logic. However, arguers always

need to find ways to express a valid relation between what they claim and how they

support it.

Metastrategic assessment mode

The "know-how" dimension of cognitive performance is mainly related to the

metastrategic assessment mode. This mode involves a type of metamemory (Schneider,

2008), meaning that it refers to the implementation of strategies that are remembered to

have some greater influence than others regarding the performance goals. This feature

renders metastrategic knowing higher in its operations than those at the metacognitive level

(Kuhn, 2000b).

Metastrategic knowing has elsewhere been defined as meta-task understanding (Kuhn

& Pearsall, 1998), i.e., as "understanding and awareness of the nature and requirements of

the task" (p. 228). Such understanding can be manifested in argument performance through

two main ways: a) through the presence of some specific argumentative discourse elements

rather than others, or b) through the implementation of certain argumentative strategies that

presuppose a high level of metacognitive knowing. The latter is also manifested through the

avoidance of those discursive genres, moves, or strategies that are considered to hinder or

to simply differentiate themselves from competent argumentation.

Epistemological assessment mode

Finally, the epistemological assessment mode is related to the epistemological or

"know-be" dimension of cognitive performance. In argumentation, this type of

metaknowing can be either *epistemic* or *pragmatic* (for a distinction between epistemic and

pragmatic actions, see Kirsch & Maglio, 1994). Regarding the quality of arguments per se,

defined in this study as epistemic, the following assessment criteria have been proposed in

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the field of informal logic (Johnson & Blair, 1994) and remain universally accepted thus far: a) relevance, indicating either the relevance of the premises offered in a single argument or the relevance of a proposition to an issue under discussion; b) sufficiency, indicating whether the premises provide sufficient evidence for the conclusion to be drawn; and c) acceptability, indicating that the premises of an argument should be acceptable to the arguer, the audience to which the argument is directed, and generally to the critical community in which they are situated. However, the quality of argumentation can also be judged in terms of the fulfillment of an action, defined in this study as pragmatic, indicating the achievement of an evident relevant goal resulting from the argumentative activity. In education-based argumentation, such results mainly refer to cognitive actions, such as problem solving or conceptual change through collaboration, also known as "collaborative learning" (Dillenbourg, Baker, Blaye, & O´Malley, 1996).

Method

As stated at the beginning of this review, a significant heterogeneity and variety of perspectives are observed in the argumentation literature. Therefore, to provide a more concrete account of what argumentative competence is and how it can be assessed, we chose the integrative literature review method (Torraco, 2005). Compared with other types of reviews, integrative synthesis aims to identify the common aspects of various approaches and to provide a comprehensible understanding of an ill-defined concept or situation. Therefore, the goal of this article is to integrate the various analytical perspectives and evaluations of argumentative competence expressed to date in the field of education by applying a common interpretive framework to the studies involved. The upper goal of this review is to help both educational researchers and practitioners to obtain a clearer image of

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what skills students and teachers shall apply in order to be considered argumentatively competent.

Research Questions

Specifically, the research questions that motivated this review are as follows:

1. What are the most common ways of defining and analyzing arguments produced by the participants? Is the focus on product (form), procedure (strategy), or process (goal)?

2. What are the most commonly used criteria for assessing the quality of the participants' argumentation?

3. Are the methods of argument analysis and assessment related to the study variables, such as the participants' age and role, the task demand, or the relevant independent variables?

4. Are there any clear relationships a) between argument analysis approaches and assessment modes and b) among the argument assessment criteria?

Data Collection

To identify the relevant literature for this review, we conducted a systematic search of the electronic databases of Wiley, ScienceDirect, and Springer. Our search included scientific articles published during the last 25 years (starting year: 1985), and additionally a number of representative book chapters that were considered highly relevant to the topic. The main search criterion applied was the appearance of the word or morpheme "argument" or its synonym "informal reasoning" in the title. The following selection criteria were also applied:

- *Content relevance* and, more precisely, a) the focus of the article relying (at least partially) on argumentation as the object of observation or dependent variable

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and b) some type of implicit or explicit relation to the educational context, either as

a setting of application or as a general mechanism of competence development.

- *Clarity*, indicating the pre-condition of a clear empirical contribution in the

field. Given the vast research in the field, we included only studies that propose or

apply some system of argument analysis and assessment and that report

observations or results.

- *Language*. We selected American or British English as the only accepted

languages of publication. Two main points justify this criterion. First, only a few

articles published in languages other than English appeared in our search results.

Second, it is common knowledge that many francophone authors focus on the

developmental aspects of argument as a natural ability that emerges spontaneously

as a result of age. As stated, this criterion does not meet our goals. In fact, due to

the second reason, most francophone articles might use words more specific than

"argument" in their titles, which also justifies the first point.

In total, 5625 search results were obtained. When the abovementioned criteria were

applied, the number was reduced to 97. This remarkable reduction was mainly due to the

extended use of the word "argument" to refer to any controversial topic and animated

discussion about such topics. Another reason for the significant exclusion is that most

research on argumentation, also in the educational field, remains at a theoretical level

without providing an empirical account of the polemical issue at hand: the analysis and

assessment of argumentative competence.

Data Analysis

For the data analysis, we followed an iterative process of data categorization and

comparison, which is also a representative method of integrative reviews (Whittemore &

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Knafl, 2005). To conduct this process, grounded analysis techniques of questioning and

comparison (Glasser & Strauss, 1967) were notably helpful. Specifically, the following

steps were adopted:

- A first-level coding of the studies' contents regarding our research questions

  focusing on study variables, argument analysis approaches, and argument

  assessment criteria. This initial coding was open (Strauss & Corbin, 1996) to all

  three dimensions in the sense that no predefined categories were applied.

- After comparison of the first codifications obtained, a second-level coding

  and grouping was performed, this time with emerging general categories. These

  categories were a) type/age of participants, task demand, scaffold type, person-

  related and task-related factors for the first dimension; b) a focus on form, strategy,

  or goal for the second dimension; and c) metacognitive, metastrategic, and

  epistemological skills criteria for the third dimension.

- The results obtained from the second coding were compared, and several

  close options for each category emerged, resulting in a final interpretive coding

  scheme of argumentative competence analysis and assessment (see Table 2).

- All studies were re-coded according to the new scheme, confirming that all

  relevant emerging data are identified with the categories proposed. In this way, the

  construct validity was confirmed.

- At all levels of the coding, three independent raters were used (the article's

  three authors). At the end of each coding, the raters' results were compared. The

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inter-rater reliability ranged between K=0.72 and K=0.9 for all phases of coding.

The few remaining discrepancies were resolved through discussion.

Study variables

This dimension includes the main study characteristics that might influence the

selection of one argument analytical approach or assessment mode over another. These

characteristics refer to variables either related to the participants involved or to the task and

intervention they participated in. The following coding categories emerged:

1. Participants, i.e., the age range and role of the study participants. The following sub-

   categories emerged: a) "children," i.e., elementary school students or children in the

   age group 7-11; b) "adolescents," i.e., secondary school students or adolescents in

   the age group 12-18; c) "adults," i.e., university students or young adults (non-

   teachers) in the age group 19-30; d) "teachers," including both pre-service and in-

   service teachers; and e) "various," in which various ages are considered with no

   specific student or teacher role.

2. Task demand, i.e., the task of argumentation that is proposed to the participants and

   that forms the object of analysis and assessment. This category can indicate one or

   more of the following types: a) "written," i.e., the participants are asked to produce

   a written argument; b) "oral," i.e., the participants' competence to argue orally in

   dyads or small groups is assessed; c) "semi-oral," i.e., the participants are asked to

   produce a computer-mediated dialogue; d) "classroom discourse," i.e.,

   argumentation is assessed as it occurs between teachers and students during class; e)

   "interpretation task," i.e., the participants are asked to assess or classify already

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constructed arguments; and f) "interview," i.e., arguments are assessed as they emerge in interviews.

3. Type of scaffold, referring to the specific intervention implemented by each study that was proven to improve the quality of argumentation. These scaffolds can be a) "argument teaching," referring to the explicit teaching of argumentation theory; b) "content teaching," referring to teaching sessions focusing on the subject of argument; c) "a priori guidance," i.e., relevant information about a guiding structure is previously given to the participants; d) "computer-supported," referring to any computer-based scaffold; and e) "during task," referring to any verbal guidance during the assigned task.

4. Person-related factors, indicating any influencing factor (in observational studies) or independent variable (in experimental and quasi-experimental studies) related to participants´ personal characteristics. These factors are a) "age/grade," i.e., age is considered as a factor; b) "ability," i.e., school performance and/or measured intelligence is considered as influential; c) "prior knowledge," i.e., previous knowledge affects the argument quality; d) "education level," i.e., the academic level is taken into consideration; e) "epistemological beliefs/level," i.e., awareness of the norms of argumentation or general attitude towards the specific knowledge; f) "gender," i.e., the participants' gender is a relevant independent variable; and g) "other socio-cultural aspect," i.e., any other factor related to the social or cultural status of the person is considered.

5. Task-related factors, including all those factors or variables that relate to the organization of the task, such as a) "orientation," indicating participants'

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argumentative orientation towards the topic and/or any pre-existing difference of opinion; b) "context," referring to the goal condition of argumentation, either as it is defined by the researchers or as it is perceived by the participants; c) "topic," i.e., when the issue influences the quality of the argument; and d) "other", for any other factor related to the specific structure of the task proposed, e.g., whether the task is organized individually, in dyads, or in groups.

Argument analysis approaches

As anticipated previously in this article, the argument analysis approaches offered various definitions of argument in terms of their forms, strategies, or goals. Several additional categories emerged regarding strategy and, more precisely, the following frequently mentioned argument moves: a) "claim/thesis/theory" for any move that serves as the initial contestation of an argument; b) "counter-argument/antithesis/attack" for any move that serves as an objection to a party's initial contestation; c) "defense/support/justification" for any move that supports a claim or a counter-argument; d) "concession/compromise/accept" for any move of consensus; e) "outcome/conclusion/revision" for any move of summing-up; and f) "rebuttal/counter-opposition" for any move of objection to an objection, thus strengthening the initial contestation.

Additionally, regarding goals, the following sub-categories emerged: a) "persuasion," i.e., the focus is on winning an argument; b) "negotiation of meanings," i.e., the focus is on argumentative interaction as a process of epistemic negotiation; and c) "critical discussion," i.e., the model of critical discussion proposed by the Pragma-dialectical School is applied .

Argument assessment criteria

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Finally, regarding argument assessment, we propose three general modes based on the three types of knowing proposed by Kuhn (1999, 2000a, 2000b), namely, metacognitive, metastrategic, and epistemological knowing. The metacognitive mode is divided into three categories, i.e., structure, conceptual quality, and epistemic quality, with separate criteria for each. These criteria, which emerged from the studies reviewed, are a) "length," referring to the number of statements (claims and/or reasons) produced; b) "complexity," referring to the more or less complex argument structures that emerge; and c) "clarity/coherence," referring to the coherent connection among all statements.

Another category of metacognitive knowing refers to the quality of the ideas expressed and is referred to as conceptual quality. Specifically, the authors reviewed are interested in a) "conceptual relevance," indicating the depth or sophistication of concepts used; b) "knowledge integration," referring to whether participants actually use the provided for the task information for their own argumentation; and c) "originality," indicating the originality of the ideas proposed while arguing on a given topic.

Finally, participants' arguments are assessed in relation to their basic knowledge about the epistemic quality of those arguments. This assessment is made explicit through criteria evaluating a) the "use of pre-defined argument schemes", such as those proposed by Walton (1996) or the argument structures used by Ricco (2003) or Neuman (2003); b) the "use of correct and valid evidence" and/or the avoidance of pseudoevidence (Kuhn, 1991); and c) the "explicit relations" among argument elements/premises, either through diagramming arguments (Lund, Molinari, Séjourné, & Baker, 2007), or as a verbal justification of the relation between claims and evidence (Sandoval & Millwood, 2008; McNeill, 2008).

Regarding the metastrategic mode, there are four main methods of addressing it. The

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first method is through the meta-element presence, i.e., the presence of concrete discursive elements relevant to a higher quality of argumentation. These elements can be the following: a) "warrant/backing," i.e., any additional support to the claim; b) "counter-argument/rebuttal," i.e., any type of objection raised; c) "qualifiers/meta," i.e., any meta-statement or elaboration; d) "clarification," i.e., any attempt to clarify or verify; e) "question," i.e., any indirect stimulation for an argument; f) "explanation," i.e., any causal reasoning used to support a claim; g) "challenge," i.e., any direct stimulation for an argument; h) "evaluation," i.e., any justified judgment of value or comment; i) "introduction," i.e., any preparation for the arguments that follow; j) "example," any use of analogy in a positive or negative way (counter-example); or k) "hypothesis", i.e., any conditional reasoning supporting an argument. The second method is through the meta-element type, i.e., through the distinction among qualitatively different types of argument elements, such as a) "claims/reasons," b) "evidence," or c) "other".

The third and fourth methods of applying a metastrategic assessment mode are by assessing the level of task awareness, which we previously called "meta-task understanding" (Kuhn & Pearsall, 1998). Specifically, meta-task argument refers to the implementation of argumentative strategies, such as a) "two-sidedness," or the consistent consideration of alternative viewpoints throughout one's argumentation and the avoidance of "my-bias" perspectives (Perkins, 1989); b) "theory-evidence co-ordination" (Kuhn, 1991, 1992, 1993; Kuhn, Shaw, & Felton, 1997); c) "use of strategic sequences of moves," as in Felton & Kuhn (2001); and d) "broadening the space of debate" (van Amelsvoort, Andriessen, & Kanselaar, 2007), in which argumentation is perceived by the participants as a negotiation process. On the other hand, meta-task non-argument refers to the distinction between argumentation and other discursive genres or moves, such as the use of "narration"

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(Auriac-Peyronnet, 2001), "explanation" (Brem & Rips, 2000), or "fallacies" (Weinstock, et al., 2006).

Finally, the epistemological assessment mode relates to an epistemological understanding of the norms and objectives of good argumentation. This understanding can be manifested either through the satisfaction of the three epistemic criteria previously discussed, namely, "relevance," "sufficiency," and "acceptability" (Johnson & Blair, 1994) or through the fulfillment of some pragmatic criteria, such as "collaborative learning" or "problem solving".

Findings

The findings are classified into two large categories: the descriptive findings, providing an overview of the state of the research in the field, and the generative findings, oriented toward providing practical guidelines and theoretical hints to shed more light on the ill-defined area of the study of argumentative competence. Specifically, the descriptive findings are presented as the frequencies of the main aspects of the studies in the review, the most used argument analysis approaches, and the most predominant argument assessment criteria applied in the reviewed studies. The generative findings are based on the relations among the three main constructs of the study (i.e., the study variables, the analysis approaches, and the assessment dimensions; see also the research questions). These relations are evaluated through an analysis of frequencies and based on the Phi coefficient measure as a measure of the association between two binary variables (2x2 cross-tabulation analysis). Our option for Phi is based on its ability to measure both the strength (significance) and the direction (negative or positive value) among pairs of binary variables (Bryman & Cramer, 2005). Moreover, Cramer's V has been used for the

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association between variables with more than two categories [2xn[1] cross-tabulation analysis

(Volker, 2006)[2]].

Descriptive Findings

Before we present the frequencies of the studies observed in relation to the abovementioned variables, we wish to indicate that because there were 97 studies analyzed, percentage and numerical frequency approximately coincide. We work with frequencies and percentages throughout the paper when we refer to a fraction of the sample; we only use frequencies when we refer to the whole sample, because they roughly correspond to percentages.

General study aspects

First, we consider it relevant to present some general aspects of the studies reviewed to provide a more comprehensible view of the phenomenon explored in this article. Specifically, with regard to the type of participants, a significant majority of studies are devoted to adolescents (59), and the presence of adults is also significant (34), whereas children (7 to 11 years old) are the target participants in a few studies (16). Among the adults, a considerable number (13) refers to teachers (8 focus on pre-service and 5 on in-service teachers).

Considering the tasks performed by the participants, the majority of the researchers apply written argumentation tasks (32) followed by oral dialogue or interpretation tasks (27 studies for each), whereas 20 studies also or exclusively propose a computer-mediated dialogue task to the participants. Classroom discourse and interviews are equally present

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[1] All contingency tables had a maximum of 2 categories in rows, and 3, 4, 5 or 6 in columns, depending on the variable as indicated in the text.

[2] Since all contingency tables were 2xn (with n <6), we took an effect size of .1 as small, .3 as medium and .5 as large (Volker, 2006).

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(14 studies for each). A synthetic table of all studies with their main identity characteristics, i.e., participants and task demand, is presented in Appendix A (Table A.1).

Finally, with regard to the independent variables or contextual factors that have been tested for their influence on argument quality, 57 are scaffold-related, and most focus either on argument teaching (34) or on some computer-supported intervention (18). Fewer studies (37) present argument quality as being influenced by task-related aspects, such as the topic (12 studies) or the argumentation context (10), whereas 30 studies focus on the relation between argument quality and the participants' characteristics, such as their age/grade (13) or intellectual ability (9).

In sum, argumentation has been mainly treated as a competence of adolescents and adults, manifested through written, oral, semi-oral, or argument interpretation tasks, and scaffolded with the explicit teaching of argument or the use of computer tools. Also, the design of argument-oriented interventions is not itself sufficient for a change in the quality of argumentative competence of students, teachers, or adults in general; person-related characteristics, such as age or intellectual ability, also play a role in that.

Argument analysis approaches

Remember that the analytical approach was organized around three main categories: form, strategy and goal. Additionally, given the popularity of Toulmin's Argument Pattern (TAP) in educational research, special attention was paid to whether and how it is applied in the examined studies. Regarding the previous categories, 64 out of the 97 studies focus on argument as form, 28 out of 97 define argument as strategy, whereas only 11 out of 97 studies apply a goal approach, defining argumentation either as a persuasion or as a negotiation process.

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In relation to whether researchers also apply TAP in their analysis, the form approach "wins" with 28 studies applying TAP. The 2x2 cross-tabulation analysis showed a strong relation between taking the form analytical approach and using Toulmin's pattern of analysis, with a large effect size [$\chi2$ (1) = 20.29, *phi* = .457, *p* =.001]. The same dependence does not apply for the strategy approach; only 4 studies that used the strategy analytical approach (combined with form) applied TAP [$\chi2$ (1) = 4.07, *phi* =.-.209, *p* =.044]. Instead, those studies may include as main argument elements one or more of the following: a theory or claim presentation (26/28), a counter-argument, antithesis, or attack move (25/28), a defense, support or justification move (24/28), a rebuttal or counter-opposition move (21/28), a concession, compromise, or accept move (12/28), and finally, an outcome, conclusion, or revision move (9/28). This result confirms the findings of Kuhn and her colleagues (e.g., Kuhn, Goh, Iordanou, & Shaenfield, 2008), who view argumentative competence as a 4-tier packet consisting of the construction of claims, the construction of an objection, the justification of both claim and objection, and the rebuttal of the objection. Finally, the relation of the studies that follow the argument as goal approach to the use of TAP again shows a non-homogeneous distribution. We observe that none of the studies that follow the goal analytical approach apply TAP [$\chi2$ (1) = 5.03, *phi* = -.228, *p* =.025]. Overall, the results show a strong effect of the relation between choosing the form analytical approach and applying TAP, with the reverse also being true, i.e., neither choosing form nor applying TAP, although with weaker effect size.

Figure 1 shows the distribution of the total sample according to the three analytical approaches. It is also worth mentioning that only 6 studies combine analytical approaches. All 6 combine form and strategy, labeled as a "mixed" approach in the pie chart (see Figure 1).

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In conclusion, it is observed that when argument is viewed as a form product, most researchers apply TAP. However, when argument is analyzed as a strategic move, the Kuhnian approach is more common. Few studies follow a more holistic approach, considering argumentation as a goal-oriented activity; in this group, both persuasion and negotiation goals matter. Finally, some researchers use both argument form and strategy as their units of analysis in their studies.

Argument assessment criteria

In this section, we analyze the distribution of studies according to the criteria used to assess argumentation. As mentioned in the introduction, we organized the assessment criteria according to three main modes, i.e., the metacognitive, the metastrategic, and the epistemological mode, each classifying a set of categories and each category combining several criteria (see Table 2). The frequencies of the studies for each assessment mode, each category, and each criterion are presented in Figure 2.

Specifically, all labels in the x-axis of Figure 2 are followed by the number of studies in the category over the total of that category. The labels for each mode are written in uppercase. The categories of each mode are also written in uppercase with the specific criteria in lowercase. The first bar corresponds to the studies that used the criteria of the metacognitive mode (85/97) followed by the bars that correspond to the studies that, within this dimension, used any of the criteria in the category structure (54/85) followed by each criterion that conforms to the structure category, namely "length" (15/54), "complexity" (29/54), and "coherence" (17/54) The following bar on the right corresponds to the second category in the metacognitive mode, namely, conceptual quality (31/85), followed by the three criteria in this group: "conceptual relevance" (19/31), "knowledge integration" (6/31), and "originality" (8/31). Finally, the last category in the metacognitive mode is epistemic

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quality (66/85) with three specific criteria: "pre-defined schemes" (12/66), "use of valid

evidence" (46/66), and "explicit relations" (27/66).

Again related to Figure 2, the metastrategic categories are presented after the

metacognitive ones, with 87/97 studies using this general assessment mode (89/97). The

metastrategic mode has four categories: meta-element presence (75/87), meta-element type

(34/87), meta-task argument (45/87), and meta-task non-argument (17/87), again all

appearing in uppercase with frequency numbers after the label. The first category in this

mode, meta-element presence (75/87), is formed by 11 criteria: "warrant/backing" (29/75),

"counter-argument/rebuttal" (53/75), "qualifiers/meta" (24/75), "clarification" (15/75),

"question" (16/75), "explanation" (21/75), "challenge" (12/75), "evaluation" (7/75),

"introduction" (12/75), "example" (12/75), and "hypothesis" (3/75). The second group in

the metastrategic mode is the meta-element type (34/87), which is composed of three cases:

"claims/reasons" (18/34), "evidence" (14/34), and a category of "other" (6/34). As we can

see, apart from the last group, the studies proposing some concrete quality typology are

nearly homogeneously distributed between those focusing on argument and those focusing

on evidence types.

The third category in the metastrategic mode is meta-task argument (45/87) and is

formed by 4 specific criteria: "two-sided" (21/45), "theory-evidence coordination" (15/45),

"use of strategic moves" (17/45), and "broadening the space of debate" (3/45). The last

subcategory in the metastrategic mode is meta-task non-argument (17/87) with three

criteria: "narration" (4/17), "explanation" (8/17), and "fallacies" (5/17).

Finally, the last assessment mode is the epistemological mode with 2 categories:

epistemic criteria (18) and pragmatic criteria (17). The frequencies of the specific criteria

used in this mode are as follows: for epistemic criteria, "sufficiency" (8/32), "relevance"

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(11/32), and "acceptability" (12/32) and for pragmatic criteria, "collaborative learning" (14/32) and "problem solving" (3/32).

Additionally, given that the categories were not mutually exclusive, we present an additional figure (Figure 3) showing the number of studies that used only the criteria of the metacognitive mode (7), the metastrategic mode (8), the epistemological mode (2), the criteria of a combination of the metacognitive and the metastrategic modes (49), a combination of the metacognitive and epistemological modes (2), a combination of the metastrategic and epistemological modes (3), or finally, a combination of the criteria of all three modes (26). We observe a higher use of the combined assessment mode that includes the metacognitive and the metastrategic criteria.

In sum, in the metacognitive mode, the most used criteria are structural complexity, conceptual relevance, and the use of valid evidence. In the metastrategic mode, the use of counter-arguments and rebuttals, the construction of arguments that consider the other, and the distinction from or the avoidance of explanation predominate. The most common criterion in the epistemological mode is the achievement of some type of collaborative learning as a result of argumentation. Finally, regarding the assessment modes in general, the metastrategic mode is the most applied usually in combination with the metacognitive mode.

Generative Findings

Relations between argument analysis approaches and study variables

In this section, we examine the relations among the analysis approach used by the studies and the study variables. Each category of the analysis approach has been related to each of the following study variables: participants, task demand, type of scaffold, person-related and task-related factors (see Table 2). As observed in Figure 1, among the three

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categories for the analysis approach, 64 adopted the form of analytical approach (either by itself or combined with the strategy), 28 adopted the strategy (either by itself or combined with form), and 11 applied the goal approach. In the following sections, we examine the relationship between each analytical approach and the study variables.

When the studies that apply each analytical approach (form, strategy, and goal) were crossed with the variable participants (children, adolescents, adults, and teachers), we observed several biases of medium effect size for form and goal but not for strategy. For form, we observed that adolescents (36/57) and teachers (10/14) were the most frequently chosen participants [$\chi2$ (3) = 8.7, p =.034, Cramer's V = .314]. However, the studies that apply the goal approach strongly tend to focus on children (3/12) or on adults (5/13) according to the large effect size [$\chi2$ (3) = 14.6, p =.002, Cramer's V = .418]. Instead, the distribution of frequencies for strategy according to type of participants was not significant. We must consider that 9 studies were developmental and focused on several ages; therefore, these studies were not included in this analysis (see Table 3).

The second study variable is task demand with 6 categories: written, oral (pooled with classroom discourse), semi-oral, interpretation task, interview, and any combination of the above. The cross-tabulation of the variable task demand and each analytical approach also yielded some biased distributions. For instance, for form approach, we observe that written (81.3% with 13/16 studies), interview (83.3% with 5/6 studies), interpretation task (85.7% with 12/14), and any of the above combined (80% with 20/25) were the most frequently used forms in contrast to semi-oral (31.3% with 5/16) and oral dialogue or classroom discourse (45% with 9/20). The chi-square for the cross-tabulation analysis yielded a non-homogeneous distribution [$\chi2$ (5) = 19.6, p =.001, Cramer's V = .450]. This large effect size shows that there is a tendency toward avoiding any kind of oral task. For the strategy

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approach, the test for the distribution of frequencies was marginally significant [$\chi2$ (5) = 10.6, p =.054, Cramer's V= .332] showing an opposite trend although with a weaker effect size. We also observed that the frequencies were lower in general. The highest frequencies were for semi-oral (56.3% with 9/16 studies), oral dialogue and classroom discourse (35% with 7/20 studies) and the combined category (28% with 7/25 studies). The rest were notably low. Finally, regarding the goal approach, we did not find significant differences in the distribution of the frequencies [$\chi2$ (5) = 5.4; p =.365, Cramer's V = .237] (see Table 4).

The third study variable (type of scaffold) showed a homogeneous distribution across analytical approaches. The only exception was for the "argument teaching" scaffold in relation to the form approach. Among the 58 studies that adopted the form approach, 31 involved some type of scaffolding factor, distributed as follows: 13 provided explicit teaching of argumentation as a scaffold; among the other types of scaffolds, 1 involved teaching specific content, 5 provided information or guidance, 3 were based on a computer tool, 1 provided a scaffold during task, and 8 provided a combination of the above as a scaffold. For the strategy and goal approaches, the distribution of frequencies was not significant (see Appendix B, Table B.1). Frequencies for the fourth study variable (person-related factors) were much lower and scattered across the three analytical approaches (see Appendix B, Table B.2).

The fifth study variable (task-related factors) was not significant in any case. Among those that followed the form approach, only one fourth of the studies (25) involved a factor related to the task, and they were distributed across the different categories. Among the 23 that adopted the strategy approach, 4 considered the effect of a task-related variable. Correspondingly, only 1 out of the 11 studies that adopted the goal approach considered a task-related variable. All of these frequencies were homogeneously distributed across the

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categories of the task-related variable.

In sum, combining the analysis approach with the study variables, to see whether the choice of the former is related to the choice of the latter, the following significant observations emerge: Studies that apply the form approach tend to include adolescents and teachers among the participants, and avoid to give them oral argumentation tasks, but they usually involve some type of scaffold in the proposed interventions; studies that define argument as strategy show a preference towards the use of oral tasks; children and adults in general (with no specific educational role) are more usually encountered in studies that apply the goal approach.

Relations between argument assessment criteria and study variables

This section refers to the relations between the type of assessment performed by the studies reviewed and the study variables. The three main assessment modes are the metacognitive mode, the metastrategic mode, and the epistemological mode (see Table 2). The study variables tested for their relation to the type of mode are the same as those tested previously.

We did not find any heterogeneous distribution of the frequencies when we cross-tabulated the "participants" variable with the metacognitive assessment mode. However, when we examine each category of each dimension, we observe a different picture. Specifically, although we did not find any significant relations between the type of participants and the category structure, we did find a bias toward adolescents in the specific criterion "conceptual relevance" with a medium effect size [$\chi2$ (4) = 9.5, p =.045, Cramer's V = .314. Specifically, 12 out of 21 studies that use "conceptual relevance" as a criterion of conceptual quality apply it to adolescents, as shown in Table 5.

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Regarding the second main mode of assessment (metastrategic), we do not observe a significant relationship between any of the criteria in the meta-element presence category and the participants (Appendix B, Table B.3), whereas for the meta-element type, we again observe a bias toward the age of adolescence (medium effect size) but only in the criterion "claims/reasons" [$\chi2$ (4) = 10.6, p =.031, Cramer's V= .334]. Among the 18 studies that adopted this type of assessment measure, 10 focused on adolescents, 6 on teachers and 2 on university students/adults (see Table 6). For the meta-task categories, no significant relation emerged (see Appendix B, Tables B.4 and B.5).

Finally, for the epistemological mode, frequencies were lower in general, and we did not observe any bias distribution of the criteria in this dimension and the variable "participants" (Appendix B, Table B.6).

With the same rationale, when the second study variable, "task demand", was crossed with each of the three assessment modes and their categories, we found the following result. For the metacognitive mode, the distribution of studies was homogeneous. However, for the first category of the metacognitive dimension, i.e., structure, the chi-square analysis for the cross-tabulation analysis was significant for the "length" criterion with a small effect size. Specifically, we observed a weak bias towards production tasks (written, oral, interview) with 15/70 studies (21%) versus none in the other task-demand categories [$\chi2$ (2) = 6.8, p =.033, Cramer's V = .266]. In contrast, for epistemic quality, we observed that the studies that apply criteria in this category slightly tend to use interpretation tasks, with the effect size quite small, too [$\chi2$ (2) = 7.5, p =.023, Cramer's V = .279]. Within this category, the "use of pre-defined schemes" yielded significant results for the cross-tabulation analysis of frequencies yielding a medium effect size [$\chi2$ (2) = 11.6, p = .003, Cramer's V = .347]. There were 6/15 (40%) studies that used this criterion and demanded

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an interpretation task versus 7/70 (10%) that demanded a production task and none that demanded a task that combined production and assessment. The other two criteria in this category did not yield any significant results; the frequencies were distributed homogeneously across the task demand categories (see Table 7).

Regarding the relation between the task demand and the metastrategic assessment mode criteria, we found a significant result for the chi-square test with a medium effect size only for the category "meta-element presence" [$\chi2$ (2) = 11.6, p =.003, Cramer's V = .346]. There were 60 studies whose task demand was a production task. These tasks were distributed as 12 written, 11 dialogue, 12 semi-oral, 8 classroom discourse, and 6 interview. In contrast, there were only 7 studies whose task was an interpretation task and 8 studies that demanded a combination of both. However, none of the specific assessment criteria in this category yielded significant results; the frequencies were scattered across the criteria. Again, when we crossed the criteria in the epistemological mode, none of the frequency distributions yielded significant results (see Appendix B, Table B.7).

Finally, regarding the type of influencing factors, none of the tested variables was associated with any of the assessment dimensions or categories (see Appendix B, Tables B.8, B.9, and B.10) except for "argument teaching" through a course. There were 57/97 studies that included as a scaffold some explicit teaching of argumentation, and 54 out of these 57 used at least one criterion of the metacognitive mode of assessment [the results were significant although all criteria showed a small to medium effect size: complexity, $\chi2$ (1) = 5.48, p =.019, phi = .238; originality, $\chi2$ (1) = 3.07, p =.074, phi = -.178; epistemic quality, $\chi2$ (1) = 4.93, p =.026, phi =.225; valid evidence use, $\chi2$ (1) = 5.5, p =.019, phi = .239; and relations between evidence and reasons, $\chi2$ (1) = 8.4, p =.004, phi = .295]. The

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remaining criteria were scattered across the categories with no significant results for any other influencing factors.

In sum, regarding the relation between argument assessment criteria and study variables, to test whether they influence one on another, the following observations emerge: Studies that use adolescents as participants are particularly interested in assessing the conceptual relevance of their arguments, and also they search for the emergence of certain types of claims or reasons, as a main metastrategic criterion; regarding the task demand, studies that assess argumentation on basis of the length of arguments and the presence of specific discursive elements tend to use production tasks, such as written, oral, and semi-oral argumentation tasks, whereas when participants are asked to assess already produced arguments (interpretation tasks), epistemic quality is of greater importance; finally, among types of scaffold, argument teaching interventions are especially related to the assessment of participants metacognitive knowing.

Relations between argument analysis approaches and argument assessment modes

Finally, this section addresses the last research question, which refers to the relation between the argument analysis approaches and the argument assessment criteria. We already observed that all studies use one or more of the following assessment modes: the metacognitive, the metastrategic, and the epistemological modes. The following analysis considers the possibility that the use of these argument assessment modes is related to any of the three analytical approaches, namely, form, structure, and goal.

The chi-square test shows that there is a significant relation between using the metacognitive assessment mode and adopting the form approach, with an effect size between medium and large [$\chi2$ (1) = 14.8, p =.001, phi = .391] in 62/64 studies. Interestingly, there is a strong relationship between defining argument as form and using

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Toulmin's analytical scheme [$\chi2$ (1) =20.29, p =.001, *phi* = .453]. Moreover, we did not

find any significant relation between defining argumentation by means of the strategy

analytical approach and applying the criteria of the metacognitive dimension. Our data

show that among the 85 studies that apply the metacognitive mode, only 22 define

argumentation using the strategy analytical approach [$\chi2$ (1) = 2.97, p =.084, *phi* = -.175].

Finally, the relation between the goal approach and applying criteria in the metacognitive

assessment dimension is also negative with a small effect size [$\chi2$ (1) = 6.58, p =.010, *phi* =

-.261]. We found that out of the 85 studies that apply the metacognitive mode of

assessment, only 7 adopt the goal approach to define argumentation.

The tests for the relation between using criteria of the metastrategic dimension and

adopting each analytical approach were not significant for form or goal, whereas the test

was slightly significant for strategy with a small effect size [$\chi2$ (1) = 4.5, p =.033, *phi* =

.216]. All 28 studies that defined argumentation as a strategy used criteria belonging to the

metastrategic assessment mode. Concretely, the test was significant due to the category

meta-element presence [$\chi2$ (1) = 5.41, p =.020, *phi* = .236]. The chi-square test was

significant for all the criteria in this category, except for the use of rebuttals and counter-

arguments because rebuttals and counter-arguments are also used when argumentation is

not defined as a strategy. Fifty-five percent of the studies that adopt the form approach also

use this criterion versus 62.2% that adopt the strategy approach and 27.3% that adopt the

goal approach. In fact, the use of rebuttals and counter-arguments as criteria to assess

argumentation was the most frequent in general (54% of the total sample used) (see Figure

2).

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Finally, regarding the epistemological assessment mode, we did not find any significant relationship between this dimension and the analytical approach variables. The frequencies were more homogeneously distributed.

In sum, as shown in Table 9, studies that use the metacognitive assessment mode mostly use the form analytical approach; studies that use the metastrategic mode are mostly related to the strategy approach; finally, studies applying the epistemological mode use any analytical approach. Nonetheless, we also observe that when we refer to the exclusive use of criteria of one mode rather than the others, the results are notably limited. Only 6 exclusively metacognitive studies focus on argument as form, 5 metastrategic studies focus on argument as strategy, and only 1 epistemological study follows the combined analytical mode.

Relations among argument assessment criteria

Finally, we investigated the relations among the various argument assessment criteria. This analysis allows for a clearer understanding of the assessment of argumentative competence, as shown in Table 10.

Some significant connections among the various assessment modes and criteria are observed. First, within the metacognitive assessment mode, structural quality (STR) and conceptual quality (COQ) are positively related. The chi-square analysis yielded a medium effect size [$\chi2$ (1) = 11.5, *p* =.001, *phi* = .345]. However, structural quality is negatively related to meta-task non-argument in the metastrategic dimension also yielding a medium effect size [$\chi2$ (1) = 8.6, *p* =.003, *phi* = -.298]. Moreover, within this dimension, the meta-element presence is slightly positively related to the meta-element type [$\chi2$ (1) = 3.55, *p* =.048, *phi* = .191] and to the meta-task argument [$\chi2$ (1) = 6.4, *p* =.010, *phi* = .257], both analyses yielding a small effect size. Finally, the epistemological dimension is the most

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distributed compared with the other two. The only significant relation was between

epistemic criteria (sufficiency, relevance and acceptability) in the epistemological mode

and the epistemic quality criteria in the metacognitive assessment mode, yielding a small

effect size [$\chi 2$ (1) = 4.4, p =.036, phi = .213].

Discussion

Our findings contribute in at least two ways to the field of educational argumentation.

First, the results lead to a clearer idea of the nature of argumentation and argumentative

competence. Second, they offer practical guidance to new researchers in the field of

education regarding what matters in argumentation and how it can be assessed. For reasons

of clarity and readability, we divide the Discussion section into 4 parts, namely: Nature of

argumentation, Nature of argumentative competence, Practical implications, and Study

limitations.

Nature of argumentation

Argumentation has mainly been treated as a matter of form, therefore strengthening the

argument-as-product approach of argument analysis. Moreover, when arguments are

viewed as form-products, Toulmin's Argument Pattern (Toulmin, 1958) is the most

common method to analyze them, with a strong effect size for the relation between these

two variables in the contingency table. Interestingly, the use of evidence, which includes

Toulminian "backings" and "data", is among the most common assessment criteria in

education. However, when arguments are viewed as dialogue strategies-moves, researchers

tend to follow D. Kuhn's (1991) approach of identifying arguments as theories,

justifications, counter-arguments, and rebuttals. Interestingly, counter-arguments and

rebuttals have a predominant position in all the reviewed studies, either as units of analysis

or as assessment criteria. Finally, few researchers view argumentation as a goal-oriented

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activity. This goal is generally not perceived as an epistemic goal, i.e., argue to argue, but as a collaborative learning goal, i.e., argue to learn. The presence of all three approaches of argument as form, strategy, and goal confirms the triple nature of argumentation as "a verbal, social and rational activity" (van Eemeren, Grootendorst, & Snoeck Henkemans, 2002, xii).

Nonetheless, a question regarding which of three analytical approaches to apply emerges. A possible answer emerging from our study gives weight to the influence of the age of the participants involved: when studying adolescents, the form approach seems to be the most used, instead primary school children are "tested" for their argument skills using more goal-oriented approaches. This difference possibly relates to the two-fold nature of argumentation as both an ability that emerges quite early in children (Anderson, Chinn, Chang, Waggoner, & Yi, 1997; Orsolini, 1993; Stein & Miller, 2003) and a skilled performance that potentially emerges in late adolescence and early adulthood as a result of education (Golder & Coirier, 1994; Kuhn & Udell, 2003). Having this in mind, researchers may prefer to use a more contextualized goal-oriented approach to guarantee for more skillful children´s argument behavior. For example, Auriac-Peyronnet (2001) studies the passage from narration to explanation of 10 and 11 year-old children, whereas Golder (1992) investigates the hypothesis of gradual use of argumentative negotiation markers by participants from 10 to 17 years old.

All three, form, structure, and goal approaches, in theory can be associated with any kind of task demand, including written, oral, semi-oral, and other types of argumentative performance. However, an interesting relation emerges between the formal approach and the written type of argumentation task, and the strategy approach and the oral type of task. This tendency may be interpreted in two ways. The first or "unbiased" interpretation would

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be that written argumentation can be better analyzed using argument forms as main unit of analysis, whereas oral argumentation is more evidenced through the implementation of a strategy approach. However true this claim might be, one cannot avoid ignoring the fact the most educational researchers who were interested in the written-form combination also applied TAP as their main theoretical model. On the other hand, an oral strategic argumentation approach would require the identification of those discursive moves that appear to be more argumentative than others in a specific context. The general research tendency is to apply an already proven analytical scheme, such as the one proposed by Toulmin (1956), than inventing a new coding system of dialogical moves, and distinguishing the argumentative from the non-argumentative ones, as few researchers have done thus far (e.g., Baker, 2003; Felton, 2004). Nonetheless, the "good" news is that Kuhn and her colleagues´ description of the main argument skills, i.e., argument construction, justification, counter-argument construction, and refutation, has been confirmed in both inter-personal (e.g., Kuhn, 1991; Kuhn, Shaw & Felton, 1997; Felton & Kuhn, 2001; Zohar & Nemet, 2002) and intra-personal contexts (e.g., Andersen & Garcia-Mila, 2008; Jiménez-Aleixandre & Erduran, 2008; McNeil, 2008). This finding also adds strength to the assumption that all argumentation is dialogical (Billig, 1987), including the one expressed in written form. If this is the case, then other, more dynamic models of argument analysis, rather than TAP, are akin to be used. Some scholars (e.g., Brem & Rips, 2000; Sampson & Clark, 2009; Berland & McNeill, 2010) also combine two analytical approaches, form and strategy, to lend greater depth to their results.

Nature of argumentative competence

On the basis of how argumentative competence is commonly assessed, it can be said that it is mainly viewed as a metastrategic competence, consisting of the use of strategic

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types of discourse that take the dialogical context into consideration. Also formal criteria of quality such as the complexity of the argument structures and the conceptual depth of the ideas expressed seem to play a major role in education. Finally, in terms of the validity of the produced arguments, the use of evidence and the distinction from explanation seem to predominate. The epistemic criteria of good informal reasoning seem not to have gained sufficient attention in education; the achievement of practical goals, such as collaborative learning, is more evident in the studies reviewed. This finding supports the main claim of the "argue to learn" approach (Andriessen et al., 2003; Baker, 1999, 2003, 2009; Leitao, 2000; Nussbaum & Sinatra, 2003; Asterhan & Schwarz, 2009), for which peer-to-peer interaction and learning is the desired result of the argumentative intervention. Argumentation, thus, emerges as a socio-cognitive activity oriented towards collective reasoning and sharing of understandings, as higher order learning activities do (Vygotsky, 1978).

The age of participants and the task demand also seem to play a role in the assessment of argumentative competence, as it was also shown for the preference of analytical approach. More precisely, conceptual relevance and the use of certain types of arguments are more related to adolescents´ assessment. The first one emphasizes on the good use of conceptual knowledge, whereas the second one on the good use of argument knowledge. The latter is also investigated through interpretation tasks, in which participants are asked to assess already produced arguments, rather than to produce them on their own. In this way, participants´ metastrategic knowing is better tested, as they are asked to make explicit the reasons of choosing one criterion rather than another to assess an argument. Both production and interpretation form part of an adolescent´s skillful argument performance.

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Last but not least, another interesting finding on how argumentative competence has been studied in education regards the selection of one argument assessment mode rather than another. We observe that researchers rarely choose their criteria based only on one type of meta-knowing; instead, researchers combine criteria from different types. Few studies apply pure metacognitive assessment criteria; a great majority applies a mixed metacognitive-metastrategic assessment, whereas the epistemological mode is almost always combined with criteria from the other two modes (see Figure 3). This tripartite research model (only metacognitive, mixed metacognitive-metastrategic, mixed metacognitive-metastrategic-epistemological) implies some hierarchy in the three assessment modes that follows the hierarchy of cognitive development: the epistemological meta-knowing presupposes a certain acquisition of the metastrategic knowing, which, in turn, presupposes some level of metacognitive meta-knowing skills (Kuhn, 2002).

Practical implications

As stated previously, the main contribution of this paper is the proposal of a three-tier conceptualization of argumentative competence, inspired by three types of metaknowing earlier proposed by Kuhn (1999, 2000a, 2000b), namely metacognitive, metastrategic, and epistemological. This finding has important implications for both teaching and research. Firstly, it implies that students (and teachers) can be situated on one level rather than another, accepting that each type of knowing presupposes the other. Secondly, it allows for a distinction of concrete skills to be exercised at each one of these levels. Finally, it combines each level with a distinct type of analysis, based on form, on strategy, or a most holistic perspective correspondingly.

Moreover, some concrete practical guidelines for new researchers in the field emerge, such as the following. Regarding analysis, Toulmin's argument pattern (TAP) is more

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applicable when argument form is the focus of the study. Instead, when more strategic aspects of it need to be investigated, an argumentative dialogue system seems to be more appropriate. Persuasion and negotiation are both important goals to achieve in educational argumentation; however, the latter may need more scaffolding due to its relationship to collaborative learning, which is the most common assessment criterion of epistemological knowing. Finally, when we speak of argumentative competence, adolescents and adults are the main focus. Main argument skills such as the strategic construction of counterarguments and rebuttals, the consideration of the other, and the use of good evidence to support one´s view are not spontaneous results of age. Secondary and higher education seem to be the most adequate fields for argument-oriented intervention and its explicit scaffolding. This does not mean that elementary school children are totally out of the game. However, their assessment is more based on their perception of the argument goal, and not on the skilled use of argumentative discourse and strategies, which is potentially expected later on in the age span. Finally, some insight is also gained regarding what is considered to be argumentative competence for teachers. Their competence is either viewed as a rhetorical or logical discourse put forward in classroom without considering students' reaction or interaction (e.g. Cros, 2001; Giannakoulias, Mastorides, Potari, & Zachariades, 2010) or, and most importantly, as a meaningful goal-oriented practice akin to promote learning discourse in class (Erduran, Simon, & Osborne, 2004; McNeill & Pimentel, 2010). More empirical studies are needed to shed light on the nature of efficient teaching-learning interactions in terms of promoting both students' and teachers' argumentation skills.

Study limitations

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At this point, some study limitations should be considered, giving space to replication and expansion of findings. The first one considers the limited emergence of significant influencing factors on argument quality. In order to give a more detailed account of the nature of argumentative competence, we took a close consideration of the factors that are reported to influence on its quality. Among these factors, the ones related to some type of scaffold are considered of major practical importance, as they can give important guidance at the time of designing argument-based interventions. However, only one of the emerged types of scaffold, i.e., the explicit teaching of argument, has shown a higher presence as a type of scaffold in those studies that take form as the analytical approach. Other types of scaffold were also chosen to study their effects, especially in a combined manner.

Another study limitation, and potential expansion, related to the previous one is the lack of connection between type of intervention and skill enhancement. In other words, the limited findings we provide regarding the type of factors influencing on argument quality are not sufficient for a researcher to design her intervention, knowing a priori what and how will be enhanced. A closer look on the relation between each type of independent variable and its influence, being positive or negative, on skilled argument performance is one of the future directions opened by our study. Moreover, the categorization of skills provided by our proposed framework can help future researchers to make more explicit the relation between what is being enhanced and how. Indeed, the reduction of vagueness and ambiguity regarding the term "argumentative competence" and its related skills has been the study´s main goal.

To finish, another limitation is related to the exploratory nature of the study. Being a review in an ill-defined area, it did not allow for blind practical validations of the pre-constructed interpretative framework, at least not at this phase. Nonetheless, our preference

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for a grounded approach of analysis allowed for an iterative process from a top-down to a bottom-up approach and back again, and to a first validation of our interpretative framework to the 97 studies reviewed. This first validation had led to a first conceptualization of argumentative competence as being composed of 3 main levels. More research in this direction is necessary, accompanied by a blind coding and re-classification of the categories proposed, to allow for a proposal of a conceptual model of argumentative competence in education. Let this be our main research goal, wishing more researchers and practitioners will join us in this effort.

Conclusion

From an educational point of view, argumentative competence refers to a group of skills mainly investigated in both students, especially in adolescents, and teachers. Those skills can be manifested in discourse forms, in the use of specific strategies, or as the fulfillment of an argumentation goal in a particular context. However, the different types of skills are assessable through numerous criteria as emerged from the reviewed studies, which we classified into three main meta-knowing competence dimensions mainly inspired by Kuhn (1999, 2000a, 2000b). These dimensions are the metacognitive assessment mode to which we assigned the criteria of structure, conceptual quality, and epistemic quality; the metastrategic mode composed of the criteria of the presence or type of a specific argument element and the preference or avoidance of specific discourse strategies-genres; and the epistemological mode expressed through two main types of criteria, those related to the nature of the argument and those related to the fulfillment of another "side-goal", such as collaborative learning or problem solving.

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Our article's main contribution is the construction and application of an interpretative framework (presented on Table 2) based on both argumentation theory and the data that emerged from 97 reviewed studies following a cyclical, grounded approach. This framework and its application allowed the emergence of three levels of argumentative competence analysis and assessment corresponding to the three types of meta-knowing previously presented. Practical implications that serve as guidelines for future researchers are also provided regarding the focus of the study (participants, tasks proposed, relevant independent variables).

In addition, the present review facilitates further research focusing on other aspects of the relevant studies that were addressed to some extent in the present research, such as the type of study design that best addresses the problem, the most used types of intervention and task organization, the specific independent variables and how they intervene to enhance the argument quality of students and teachers. However, a possible limitation of our study might be the undoubted gap between the assessment of a performance and the performance itself, which applies to any educational measurement (Moss, 1992). Finally, we acknowledge that more research is required to further validate our conceptual framework. In a continuously changing world, skilled argument is an important tool; thus, researchers and educators have a great responsibility to define argumentative competence in education and to propose ways to assess it. We hope that more educational researchers will work toward this goal.

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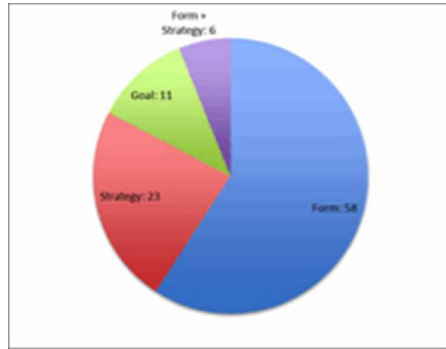
Distribution of studies according to analytical approaches (N = 97)
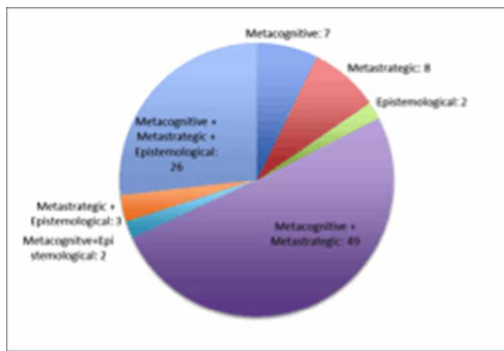78x61mm (72 x 72 DPI)

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Distribution of argument assessment modes, categories, and criteria
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Table 1

Main types of arguments considered valid by Informal Logic (in Walton, 1989, p.

14-15)

Deductively valid argument

Every person who does a good job should get regular pay that reflects the value of his work.

Alice is a person who does a good job.

Therefore, Alice should get regular pay that reflects the value of her work.

Inductively valid argument

Most people who do a good job should get regular pay that reflects the value of their work.

Alice is a person who does a good job.

Therefore, Alice should get regular pay that reflects the value of her work.

Plausible argument

It is widely accepted that people who do a good job should get regular pay that reflects the value of their work.

Alice is a person who does a good job.

Therefore, Alice should get regular pay that reflects the value of her work.

Table 1

Interpretative Framework used to Code the Data Emerged from the Reviewed Studies

Coding dimension 1: Study variables	
Participants	Children, Adolescents, Adults, Teachers, Various
Task demand	Written, Oral, Semi-oral, Classroom discourse, Interpretation task, Interview, Combined
Type of scaffold	Is argumentation successfully scaffolded in one or more of the following ways: a) argument teaching, b) content teaching, c) a priori guidance, d) computer-supported, or e) during task?
Person-related factors	Are there any factors related to the study participants that influence argument quality? If yes, which one(s): a) age/grade, b) ability, c) prior knowledge, d) education level, e) epistemological beliefs/level, f) gender, or g) other socio-cultural aspect?
Task-related factors	Are there any factors related to the argumentation task that influence argument quality? If yes, which one(s): a) orientation, b) context, c) topic, or d) other?

Coding dimension 2: Argument analysis approaches	
As **form**	Does the study adopt a *form* approach, meaning that it focuses on arguments as products, i.e. structures composed of at least one statement supported by other statements?
As **strategy**	Does the study adopt a *strategy* approach, meaning that it defines argument moves such as: a) claim/thesis/theory, b) counter-argument/antithesis/attack, c) defense/support/justification, d) concession/compromise/accept, e) outcome/conclusion/revision, or f) rebuttal/counter-opposition?
As **goal**	Does the study adopt a goal approach, meaning that it focuses on argumentation as an activity oriented towards a goal, as: a) persuasion, b) negotiation of meanings, or c) critical discussion?

Coding dimension 3: Argument assessment criteria		
Metacognitive (MC)	Structure (STR)	Is argument assessed in terms of its structural quality, meaning: a) length, b) complexity, or c) clarity/coherence?
	Conceptual quality (COQ)	Is argument assessed in terms of its conceptual quality, meaning: a) conceptual relevance, b) knowledge integration, or c) creativity?
	Epistemic quality (EPQ)	Do the authors focus on the arguments' epistemic quality, in terms of: a) use of pre-defined argument schemes, b) use of correct and valid evidence, or c) explicit relations?
Metastrategic (MS)	Meta-element presence (ME_PR)	Are there any discourse components that are considered as especially related to the quality of argumentation, such as: a) warrant/backing, b) counter-argument/rebuttal, c) qualifiers/meta, d) clarification, e) question, f) explanation, g) challenge, h) evaluation, i) introduction, j) example, or k) hypothesis?
	Meta-element type (ME_TY)	Are there any explicit qualifications related to: a) claims/reasons, b) evidence, or c) other?
	Meta-task argument (MT_AR)	Is the focus of argument assessment concentrated on the application of certain argument strategies by the participants, such as: a) two-sidedness, b) theory-evidence co-ordination, c) use of strategic sequences of moves, or d) broadening the space of debate?
	Meta-task non-argument (MT_NA)	Is argument assessment related to the distinction from other, non-argument discourse structures, such as: a) narration, b) explanation, or c) fallacies?
Epistemological (EP)	Epistemic criteria (EC)	Is argument assessment related to the satisfaction of "good argument" criteria, such as a) sufficiency, b) relevance, or c) acceptability?
	Pragmatic criteria (PC)	Is argument success assumed from the fulfillment of other related cognitive performance such as: a) collaborative learning, or b) problem solving?

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Table 2

Distribution of frequencies of the Analysis Approach across Participants

Analysis Approach	Participants			
	Children	Adolescents	Adults	Teachers
Form	7	36	4	10
Strategy	2	15	5	2
Goal	3	1	5	2

Table 3

Distribution of Frequencies of the Analysis Approach across Types of Task Demand

Analysis	Task demand						
Approach	Written	Oral	Semi-oral	Class Dis.	Interview	Assessm.	Combined
Form	12	6	5	2	5	12	16
Strategy	3	4	9	2	1	1	3
Goal	1	2	2	3	0	1	2
Combined	0	0	0	1	0	0	4

Table 4

Summary of significant relations between Analysis approaches and Study variables

Analysis Approach	Participants	Task demand	Scaffold	Other factors
Form	Adolescents, Teachers	Written, Interview, Interpretation task	Argument teaching	-
Strategy	-	Semi-oral, Oral, Classroom discourse	-	-
Goal	Children, Adults	-	-	-

Table 5

Distribution of Frequencies of Conceptual Quality Criteria across Types of Participants

Conceptual Quality	Participants					
	Children	Adolescents	Adults	Teachers	Various	Total
Conc. Relevance	0	12	5	4	0	21
Knowl. Integr.	1	3	0	2	2	10
Creativity	0	7	1	1	1	10

Table 6

Distribution of Frequencies of Meta-element types across Types of Participants

Meta-element Types	Participants					
	Element.	Adolesc.	Adults	Teachers	Various	Total
Claims/Reasons	0	10	2	0	6	18
Evidence	3	7	1	2	1	14
Other	1	4	4	0	0	6

Table 7

Distribution of Frequencies of the Assessment Modes Categories across Types of Task Demand

Task Demand	Written	Dialogue	Semi-oral	Classroom Disc.	Interview	Assessment	Combined
Structure Criteria	8	3	9	6	4	4	20
Length	3	1	5	2	2	0	2
Complexity	6	2	3	2	3	2	13
Coherence	3	3	0	4	1	2	6
Conceptual quality	4	3	9	3	2	2	8
Concept. Relevance	4	3	6	2	0	2	4
Knowl.Integration	3	1	0	1	2	0	1
Creativity	1	2	5	0	0	0	2
Epistemic quality	10	5	10	5	4	12	20
Pre-defined schemes	2	1	0	1	1	6	2
Use of evidence	8	5	7	3	4	5	15
Explicit relations	6	2	4	3	2	2	9

Table 8

Summary of Significant Relations between Specific Assessment Criteria and Study Variables

	Assessment	Participants	Task Demand	Scaffold	Other
MC	STR	-	Production-Length	Argument teaching	-
	COQ	Adolescents-Conc.Relevance		Argument teaching	-
	EPQ	-	Assessment- Pre-defined schemes	Argument teaching	-
MS	ME_PR	-	-	-	-
	ME_TY	Adolescents-Claims/Reasons	-	-	-
	MT_AR	-	-	-	-
	MT_NA	-	-	-	-
EP	EC	-	-	-	-
	PC	-	-	-	-

Table 9

Distribution of Frequencies of Analysis Approach crossed with Assessment Mode

Analysis Approach	Metacogn.	Metastrat.	Epistem.	Metacogn. +Metastr.	Metacogn. +Epistem.	Metastr. +Epistem.	All
Form	6	2	0	34	2	0	14
Strategy	0	5	0	10	0	1	7
Goal	1	1	1	5	0	2	1
Combined	0	0	1	0	0	0	4
Total	7	8	1	49	2	3	4

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Table 10

Cross-tabulation among Argument Assessment Criteria of Each One of the Three Modes

| | | MC | | | | MS | | | EP | |
		STR	COQ	EPQ	ME-PR	ME-TY	MT-AR	MT-NA	EC	PC
MC	STR		25*	39	43	19	28	4*	12	9
	COQ			23	23	11	16	4	7	8
	EPQ				49	20	30	13	16*	11
MS	ME_PR					30*	40*	11	15	16
	ME_TY						17	8	4	6
	MT_AR							7	10	13*
	MT_NA								0*	3
EP	EC									2
	PC									