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Bridging dialogic pedagogy and argumentation theory through critical questions

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Abstract

This article explores the relationship between argumentation theory and dialogic pedagogy. Arguments made in everyday discourse tend to be enthymematic, i.e., containing implicit premises. Thus, dialogue is often necessary to uncover hidden assumptions. Furthermore, evaluating logical arguments involves dialectical and dialogic processes. We articulate the role of critical questions in this process and present the Critical Questions Model of Argument Assessment (CQMAA) as a (mostly) comprehensive framework for evaluating arguments.

Students can be taught to ask and discuss these critical questions. Yet to facilitate and sustain discussion of these questions, teachers need additional tools drawn from dialogic pedagogy. We draw on Robin Alexander's conceptual framework for this purpose as well as Michaels and O'Connor's work on Academically Productive Talk. Alexander's framework includes six pedagogical principles and eight repertoires of talk. We focus specifically on teacher and student talk moves and propose that critical questions should be considered an important subset of productive talk moves that can bring rigor and purpose to classroom argumentation. Other talk moves are also needed to help students construct arguments, listen and engage with one another, and help sustain discussion of the critical questions. The CQMAA provides both a theoretical and practical link between (1) logical analysis and critique and (2) dialogic teaching.

Keywords: Dialogic teaching, argumentation, argumentation theory, logic, critical questions, critical thinking.

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Bridging Dialogic Pedagogy and Argumentation Theory through Critical Questions

There have been several notable successes documenting the educational utility of argumentation (Asterhan & Schwarz, 2009, 2016; Larrain et al., 2021; Nussbaum, 2008a). Teachers need to know how to build dialogic learning environments that contain rich and productive student discussions (Andriessen & Baker, 2012; Jonassen & Kim, 2010; Osborne et al., 2010) and that promote students' agency, contribute to sensemaking and knowledge-building, and develop students' critical thinking and argumentation skills.

Many who research argumentation in education draw on frameworks from philosophy (Dove & Nussbaum, 2018; Macagno & Rapanta, 2019) or dialogic pedagogy (Alexander, 2020; Resnick et al., 2015; Wegerif et al., 1999). However, the dialogue between those researchers who most closely identify with argumentation and those who identify with dialogic pedagogy could be strengthened. Furthermore, the diverse conceptual frameworks used by the different communities could be productively synthesized to further both theory and practice.

The goal of this article is to explain how two seemingly very different bodies of work, (1) argumentation theory (relating to formal and informal logic) and (2) dialogic pedagogy (specifically work by Alexander and by Michaels and O'Connor), can be connected. We explain the conceptual underpinning of each and show that logical analysis, at its core, is dialectical and dialogical. We then propose that a practical connection between these bodies of work can be made by using critical questions, which are evaluative questions from argumentation theory, as "talk moves" in classroom discussions.

Philosophical Perspectives on Argumentation and Discourse

Although argumentation studies involve social, psychological, and pedagogical aspects, we focus here specifically on the logical evaluation of arguments, which is a subset of the broader domain. In

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philosophy, the field of logic is the study of correct reasoning. As such, philosophical perspectives are concerned with what makes an argument valid and sound if deductive or strong and cogent if inductive. An argument is a claim (i.e., a conclusion) that is supported by reasons (the premises). O'Keefe (1983) distinguished between two senses of the term *argument:* argument as a product ("Argument-1"), such as syllogisms that are constructed, and argument as an activity ("Argument-2"), as in "having an argument with my friend." The latter has been labeled by some scholars (such as Kuhn et al., 2013) as argumentation. Argumentation is *dialectical* in that it involves a contest, so to speak, of opposing ideas. (The idea of thesis-antithesis dates back to the ancient Greeks, specifically Zeno, Socrates, and Aristotle)[2]. Argumentation is also *dialogic* because it is embodied in the discourse among human beings regarding the meaning of something (idea, event, argument). (The term dialogic is defined more fully later in the article.)

In this section, we begin from the perspective of arguments as products, then show that the evaluation of argument products is dialectical and dialogic. The concept of *critical questions* is then introduced, which provides an important theoretical and practical linkage to dialogic pedagogy. Because our specific list of critical questions is based on formal and informal logic, it is important to understand basic logical concepts.

Basics of Logical Analysis

As noted, arguments involve a conclusion inferred from one or more premises. Arguments with two premises are known as *syllogisms*. For example, consider the syllogism, loosely based on an argument made against a bill co-authored by Senator Taft in 1947 by the National Association of Real Estate Boards:

> All Democrats support public housing.
> All socialists support public housing.
> Therefore, all Democrats are socialists.

Logical analysis shows this (deductive) syllogism to be invalid because it is possible for the premises to be true while the conclusion is false, i.e. inconclusive. The premises do not connect the categories in a way that forces the conclusion to be true. The validity of an argument depends on its structure, not on the truth of the premises. A *sound* argument is an argument that is (1) valid and (2) also has true premises, thereby establishing the truth of the conclusion.

As was noted by Aristotle (ca. 350 B.C.E./1960; Smith, 2020), and later by Toulmin (1958) and others, many arguments are inductive (i.e., probabilistic). Inductive arguments are judged by the criteria of strength and cogency, not validity and soundness. *Strength* refers to whether the conclusion is highly probable given the premises, and *cogency* as to whether the premises are true (e.g., are the observations on which the argument is based accurate). Cogency is the inductive analogy of soundness for deductive arguments.

Asyllogistic and enthymematic arguments. Arguments can be asyllogistic, having three or more premises. For example, there might be a chain of reasoning or multiple reasons why a conclusion is true. For instance, giving multiple reasons for why a particular course of action is desirable might involve listing four advantages, two disadvantages and then arguing that the advantages outweigh the disadvantages. Arguments can also be complex if they contain counterarguments or rebuttals of opposing arguments. Nevertheless, arguments with complex structures can be broken down (i.e., analyzed) into parts that consist

[2] The term "synthesis" was later introduced by Fichte in the eighteenth century (and mistakenly attributed to Hegel; Schnitker & Emmons, 2013). We do not use the concept of synthesis here, because it is not well defined, but dialectic does require continued evaluative responses to opposing ideas, up to the point where the dialectic ceases.

of syllogisms and/or induction of a general premise from a series of particular observations. The individual parts can then be evaluated.

Arguments can also have premises where some are left implicit. These are known as *enthymemes.* For example:

> Lincoln was the 16th president of the U.S.
> Therefore, Lincoln was born in the U.S.

The implicit premise is that all U.S. presidents must be natural born citizens (according to Article II. of the U.S. Constitution). Many informal arguments in everyday discourse are enthymematic, having one or more implicit premises. Anderson et al. (1997) documented the enthymematic quality of arguments made by 4th graders during small-group literature discussions.

The argument about Lincoln works if the implicit proposition is known by the audience, that is, if it is part of their *common ground* (the shared and agreed upon knowledge of the parties involved, see Clark & Brennan, 1991). If not, the argument could be judged as invalid, but those who cannot follow the argument should first ask, "What does Lincoln being a U.S. president, have to do with where he was born?" The proponent of the argument should then make the implicit premise explicit; if they cannot do so, only then should the argument be judged invalid. (Hitchcock, 1998, has maintained that the missing component is really more a rule of inference than a premise per se, but this is a technical point that does not affect our overall argument.)

This example shows how the evaluation of arguments is dialogic. A key point is whether gaps in the argument can be filled in. Consider the argument:

> Joe Biden was elected the 46th President of the U.S.
> Therefore, the election was stolen by the Democrats.

This argument should be judged as invalid (a *non sequitur)* because the conclusion does not follow from the premise. There is an inferential gap. However, if someone were to inquire about the relevance of the premise, the proponent might be able to fill in the gap by providing an additional premise, such as:

> Most people couldn't possibly support Biden for president because he is a terrible candidate.

This move makes the argument stronger, but the question then becomes whether it is cogent, i.e., based on true premises. Thus, questions should be posed regarding the evidence, if any, supporting the additional premise. What did the polling data say? How reliable is the polling data? Are there other possible reasons that Trump could have lost his bid for reelection, such as his denial of the seriousness of the COVID-19 pandemic or widespread perceptions that he was racist and corrupt? These evaluative questions are known as *critical questions* (Hastings, 1962). These questions probe an argument's attributes, such as strength, validity, cogency, and soundness.

Critical Questions and Argument Schemes

The study of critical questions in argumentation theory has traditionally been linked with the concept of *argument schemes*. An argument scheme is a type of argument with a particular type of semantic content for both the general and particular premises. For example, the existence of dark clouds is evidence that it is likely to rain (Nussbaum & Dove, 2022). This is known as an argument from *sign*; very dark clouds are a

sign of rain, just as bear tracks are a sign that a bear may be nearby. There are particular critical questions that should be asked in a dialogue to evaluate an argument from sign, specifically:

1. What is the strength of the correlation of the sign with the event signified?
2. Are there other events that would more reliably account for the sign?

(Questions from Walton et al., 2007).

Very dark clouds are a sign of rain, although the correlation is not perfect. In a similar vein, if we reframe the argument about Senator Taft as an argument from a sign (because supporting public housing could be taken as a sign of being a socialist), the argument can be judged as weak because the correlation is weak (there are many nonsocialists who support public housing), and there are also other events that could account for Senator Taft's support of public housing. (After investigating the issue, he saw that public housing met a need that private industry would not meet and that it strengthened the family and improved the poor's standard of living; Davies, n.d.).

Other argument schemes require different critical questions (or CQs). For example, in an argument from expertise (a proposition "A" is likely true because an expert said so), the CQs are:

1. Is the expert a genuine expert in the domain?
2. Did the expert really assert A?
3. Is A relevant to the domain?
4. Is A consistent with what other experts say?
5. Is A consistent with the known evidence in the domain?

Although it does have roots in Aristotle's notion of *topoi* (the source of the form and legitimacy of an argument), the notion of argument schemes in contemporary philosophy and rhetoric was first proposed by Perelman and Olbrechts-Tyteca (1958) in their book, *The new rhetoric: a treatise on argumentation*. For example, they discuss such themes as an *argument from example* or *from dissociation of concepts.* The same year, Toulmin (1958) proposed that arguments in everyday life consist of six parts: claims, data (later termed grounds), warrants linking data to the claim, backing for the warrant, a rebuttal, and a modal qualifier in the conclusion (such as probably, presumably, necessarily, etc.). Many of these parts are left implicit and only provided when a question is asked, such as "What have you got to go on? "What is the relevance?" (as in the Lincoln example above), "Are there exceptions?" and "How do you know the warrant is true?").[3] These can be considered general CQs, but the term *critical questions* and the link to specific argument schemes was formally made by Arthur Hastings (1962) in his doctoral dissertation, where he classified different types of warrants into schemes. Other philosophers have subsequently proposed additional schemes and CQs. Walton et al. (2007) presented a compendium of 96 schemes, each with its own set of critical questions.

In the subsequent sixty-plus years since Toulmin introduced his model, the argument scheme and other approaches have in philosophy superseded the Toulmin model in importance, whereas the Toulmin model became the dominant one in the fields of education and communication. The Toulmin model was popularized in communication studies (including forensics, rhetoric, and literacy) through a textbook written by Ehninger and Brockriede (1963), because it provided a convenient alternative to formal logic. It was further simplified in education into a claim-evidence-reasoning format by McNeill and Krajcik (2006). The Toulmin model is rarely used by contemporary philosophers, however, as the terms used are somewhat

[3] The Toulmin model does not contain standards for evaluating the strength and cogency of arguments, other than whether a component of the model could be produced on request. (Toulmin recognized that other than grounds, the various other components were enthymematic.) Toulmin proposed the model to make a philosophical argument that different fields of argument use different types of backing (empirical, legal, arguments for ethical principles, etc.), and that arguments should be judged by field-dependent standards relating to what counts as good evidence.

vague and the argument schemes approach provides better conceptual tools for analyzing and evaluating arguments and identifying fallacies.

Argument scheme theory was, in part, developed in response to the issue of what makes an argument fallacious. Fallacies can be formal or informal. A formal fallacy relates to a flaw in the structure of an argument (as was the case with the public housing syllogism), whereas an informal fallacy relates to the use of ambiguous terms or irrelevant factors. For example, just because an authority figure says something is true does not make it true. The Romans called this fallacy *Argumentum ad Verecundiam*. However, as pointed out by Hamblin (1970), arguments that appeal to authority are not always fallacious; sometimes, expert testimony makes a proposition more likely to be true. Authority is only irrelevant from a deductive point of view, but many if not most arguments are not purely deductive. The CQs allow judgments to be made about when a particular argument is or is not fallacious. Walton and others have analyzed various "fallacies" (Walton wrote a number of books on individual ones); this work has contributed to the list of argument schemes and CQs (see Nussbaum, 2011, for a summary).

CQs help participants in an argumentative discussion evaluate arguments given in the discussion. The relationship between the participants is dialectical and rooted in dialogue; a participant forwards an argument, others ask (or should ask) critical questions, and then the proponent responds. If the response is deemed satisfactory, the argument can be judged as strong and cogent; if not, the argument can be judged as weak or fallacious. Sometimes, rather than asking a CQ, the other parties may make a rebuttal. For example, rather than asking "what is your evidence?" a critic might just argue "you have no reliable evidence" and then let the protagonist respond. In either case, the dialogue should then proceed until the goal of the dialogue is reached. Walton (1998), in *The new dialectic,* proposed seven types of dialogue, each with a different goal. The goal of a persuasive dialogue (what other scholars called a *critical discussion,* van Eemeren & Grootendorst, 1992) is to resolve a difference of opinion, but other types of dialogue might relate to inquiry, interrogation, negotiation, deliberation, or emotional catharsis and the airing of grievances.

The Critical Questions Model of Argument Assessment (CQMAA)

The type of argumentation discussed above is normative; it addresses how people should argue, including how they should evaluate arguments, but not how people actually do argue and make these judgments. There are other conceptual frameworks in the field of argumentation studies that address the latter (e.g., Jacobs & Jackson, 1982; Kuhn et al., 2013) as well as pedagogical frameworks for how students can learn to argue more critically and effectively (Nussbaum et al., 2019; Reznitskaya et al., 2008).

From a pedagogical perspective, Nussbaum and Dove (2018) noted that it is unwieldy to teach students to recognize argument schemes, not only because there are so many but also because many actual arguments do not perfectly fit a scheme or may fit two or more schemes. However, noting similarities in the CQs across different schemes, Dove and Nussbaum (2018) therefore proposed a set of quasi-general critical questions that could be posed by teachers and taught to and used by students.

The list is similar to evaluation criteria independently developed by Reznitskaya and Wilkinson (2021), but ours is specifically based on Yu and Zenker's work on complete argument evaluation (2020). Yu and Zenker posed the question of whether there is a procedure for generating all the CQs that could be asked about a particular scheme. Yu and Zenker showed that there are only a few ways an argument can go wrong. First, though, there needs to be an argument and the terms of the argument need to be well-defined, not vague or ambiguous, Second, individual syllogisms can go wrong because (a) the major (or general) premise is false (including in need of qualification), (b) the minor premise is false (including in need of qualification or more evidentiary support), or (c) the conclusion does not follow from the premises

because there is an inferential gap that remains unfilled after discussion. Finally, there may be counterarguments that work against the conclusions, such as disadvantages to a course of action or counterevidence to a scientific theory, and which outweigh the argument. Yu and Zenker turned these potential flaws into meta-CQs, such as "Is the major premise true?" The particular CQs associated with specific schemes are just instances of these meta-CQs. We contend that the meta-questions can also be used to generate more specific, quasi-general CQs that can be taught to students.

Dove and Nussbaum (2018) proposed a list of CQs that composed what they call the Critical Questions Model of Argument Evaluation (CQMAA). The list has been slightly modified over time to make some of the CQs clearer and more student-friendly and to address explanations as well as arguments.[4] The current list is:

1. **Structure:** Is there an argument or explanation here? Can we identify the conclusion? Can we identify the supporting reasons and evidence and how they relate to one another?
2. **Meaning:** What do the terms/concepts of the argument mean? Can I (or you) explain the meaning and give an example? Does the explanation make sense?
3. **Evidence Quality:** Is there evidence? How good is the evidence? Is it reliable?
4. **Soundness:** Are any of the reasons or assumptions untrue or incorrect? Does the argument use or connect with accepted scientific principles or facts?
5. **Coherent Reasoning:** Do the parts of the argument make a path that you can follow, or are there missing steps?
6. **Alternatives:** Are there other explanations, models, or conclusions that also fit the evidence? Can you rule out other or competing explanations or conclusions?
7. **Completeness:** What is missing or weak in the argument or explanation? Are there missing factors?
8. **Trade-offs** (for engineering design or socioscientific arguments)**:** Are there trade-offs (getting something at the expense of another)? Are any of the reasons on one side more important than those on the other? Is your design realistic?
9. **Overall Quality:** Given the answers to the previous questions, is it rational to accept the conclusion of the argument?

Note that the CQs can be asked in any order, except for the "bookend" questions (#1 and #9). There first must be an argument or explanation to analyze, and of course closure must come at the end. There is a rough parallel between the first and last questions and Walton's opening and closing stages of argumentative dialogue. The order of the other CQs should be determined by the participants in the dialogue, who can also ask more specific, follow-up CQs, such as what constitutes "good evidence?" These CQs are only examples of how these various categories (e.g., meaning, evidence) can be probed. The questions can be worded to make them more transparent to students at specific grade levels. (This is also why we named #4 "soundness" while it technically should be "cogency and soundness," but the phraseology of the latter was awkward.)

We contend that although the list of CQs is partial, the categories are comprehensive, as they relate to all the meta-CQs identified by Yu and Zenker (2020). In the spirit of Bakhtin (1981), we do recognize that all knowledge is provisional, and someone might come along with an argument for an additional category, pointing out a mistake in our reasoning. But the categories are intended to be comprehensive.

[4] An "argument" is a claim (i.e., conclusion) supported by one or more reasons (i.e., premises). There should be some uncertainty and disagreement about the truth of the claim. An argument attempts to reduce this uncertainty and gain consensus. While an explanation also has a conclusion inferred from one or more reasons, in an explanation there is initial agreement that the conclusion is true (Govier, 1987). For example, it is agreed that "the moon has phases" (this is the conclusion, also known as the *explanandum*), and the moon has these phases for the following reasons (these reasons are also known as the *explanans*, see Hempel & Oppenheim, 1948). People can generate arguments about which alternative explanation of a phenomenon is correct, for example by appealing to evidence or theory, so both arguments and explanations are important in science.

We view critical thinking as involving the asking and discussing of critical questions. It is hence dialectical and often dialogical. Pedagogically, it is important for students to engage in a critical discussion where CQs are asked and answered so that critical thinking and argumentation skills can be learned and developed; this is learning to argue. Scholars in argumentation studies in education use the terms *collaborative* or *deliberative* argumentation (Andriessen & Baker, 2014; Asterhan & Schwarz, 2016; Osborne, 2010) to emphasize that argument-oriented discussions need not be adversarial, with winners and losers (as in a debate), but can involve other goals (e.g., knowledge building, finding "truth"[5] through inquiry, resolving differences of opinion). These discussions can still be dialectical, involving counterarguments and rebuttals, but parties in the argument also can make concessions and change sides (Keefer et al., 2000). Nussbaum (2021) defines collaborative argumentation as participants "working together to construct and critique arguments," a definition that was informed by Mercer et al.'s (1999) notion of "exploratory talk" (vs. cumulative or disputative talk) in work on dialogic pedagogy, discussed below.

It is often a complex task for teachers to foster meaningful and productive argumentative discussions. Sometimes if teachers remain silent and just give the students freedom to talk, students will argue with one another meaningfully and collaboratively, but it depends on the topic and on the age, interest, history, and background knowledge of the students, and a host of other factors (see Asterhan & Schwarz, 2016). The scenario is likely the exception rather than the rule. Furthermore, students will probably not be using or learning about CQs, so some teacher scaffolding may be necessary. Finally, raising a CQ about an argument may initiate a discussion about an argument, but teachers likely need tools to facilitate and maintain the discussion, as well as how to bring the discussion to a meaningful conclusion. For these reasons, we next explore the tools and conceptual frameworks provided by scholars of dialogic pedagogy.

Dialogic Pedagogy and Academically Productive Talk

This work draws on several decades of research on "dialogic pedagogy" (across a variety of content areas, grade levels, and societal contexts). We first explicate a framework developed by Robin Alexander's (2020) in some detail, as it is perhaps the most fully explicated and encompassing conceptual framework for dialogic teaching and learning and against which other approaches are often compared (Kim & Wilkinson, 2019). We then describe Michaels and O'Connor's framework of Academically Productive Talk, which is closely aligned with Alexander's but is more specific.

Alexander's Framework

Alexander's framework for "dialogic teaching" draws on the work of Vygotsky (1978) and Bakhtin (1981), and also on Alexander's (2001) seminal study comparing classroom dialogue in England, France, India, Russia, and the U.S.

Dialogic teaching and the dialogic stance. Alexander (2020) defines dialogue as "the oral exchange and deliberative handling of ideas, information and opinions" (p. 128) and dialogic teaching as a "pedagogy of the spoken word that harnesses the power of dialogue…to stimulate and extend students' thinking, learning, knowing and understanding, and to enable them to discuss, reason and argue" (p. 128). The framework draws on Vygotsky (1978) to justify dialogic teaching because Vygotsky showed how talk is central to thinking, learning, mastery, and communication. It involves a *dialogic stance*[6] toward knowledge as something negotiated and recreated and toward understanding as "a product of encounters between

[5] There are various conceptualizations of "truth" in philosophy; a productive one for our purposes is Putnam's (1981) notion of truth as the propositions believed to be true by intelligent beings like us who have reached a limit of inquiry. Inquiry can be endless, as Bakhtin (1981) suggested; we may never know the "truth" absolutely, but our beliefs can approximate it.

[6] Alexander also argues that a dialogic stance fosters acculturation and democratic engagement.

different ways of arguing, knowing, and making sense" (Alexander, 2020, p. 129). These may include oral, cognitive, social, epistemic, and cultural ways of making sense, along with the underlying values of different methodological perspectives. Forming connections among different perspectives and methods reflects Kristeva's (1981) notion of intertextuality--forming linkages between different types of texts and, more broadly different forms of discursive practices--and Bakhtin's (1981) concept of heteroglossia--accounting for different languages or perspectives within a speech community.

While Bakhtin also viewed dialogue as being theoretically unending because answers lead to more questions (Wegerif, 2007), Alexander (2020) notes that in real classrooms, there are time limits in which students must gain mastery and understanding of specific ideas. Still, part of the dialogic stance is to view knowledge as tentative, evolving, and open to revision. For example, in learning about the nature of science, students should learn that even well-established scientific theories, such as Newton's Laws, can be replaced by new theories, such as Einstein's theories of relativity. In regards specifically to argumentation, Alexander notes that not all arguments need to end in consensus and that even when consensus is reached, the agreement should be considered provisional. Likewise, philosophers consider arguments as defeasible, meaning that even a consensus that an argument is strong can be diminished in the future if new evidence, alternative theories, or rebuttals are encountered or raised (Pollock, 1987).

Principles of dialogic teaching. Alexander (2020) articulated six principles of dialogic teaching which can be used for planning and reflection and for judging how dialogic a particular classroom environment is (Alexander, 2020, p. 131). The principles hold that authentic dialogue should be (1) collective (teachers and students work, learn, and inquire together, in groups or as a class), (2) supportive (students feel free to express ideas "without risk of embarrassment over contributions that are hesitant or tentative, or that may be judged 'wrong'"), (3) reciprocal (the classroom is a site of joint learning and enquiry, and whether in groups or as class students and teachers are willing and able to address learning tasks together); (4) deliberative ("participants discuss and seek to resolve different points of view, they present and evaluate arguments, and they work towards reasoned positions and outcomes"), (5) cumulative ("participants build on their own and each other's contributions and chain them into coherent lines of thinking and understanding"), and (6) purposeful ("classroom talk, though sometimes open-ended, is nevertheless structured with specific learning goals in view").[7]

In our view, learning environments need to reflect all these principles for students to have meaningful discussions of critical questions. CQs clearly relate to Principle 4 on presenting and evaluating arguments. CQs also contribute to purpose (Principle 6) by providing subgoals (i.e., resolving specific CQs) that contribute to the overall goal of the dialogue, as suggested by Walton (1998, 2013), and to gain closure (Walton's last stage), the discourse should be cumulative (Principle 5). Alexander uses the phrase cumulative talk differently from Mercer and Wegerif (Wegerif et al., 1999). The latter define cumulative talk as students building on one another's ideas but not disagreeing with one another, while Alexander views cumulative talk as discourse that is productive, leading to an overall (but tentative) conclusion and achievement of a learning goal.

Repertoires. Teachers who effectively facilitate dialogue reflecting these principles use a "broad and flexible repertoire of teaching strategies, modes of interaction and forms of both student and teacher talk" (Alexander, 2020, p. 164). These modes and forms can include direct instruction, when appropriate, but not as the dominant form of instruction. The repertoires fall into eight different categories, such as questioning, extending, or norm building. The last repertoires are "Discussion, Deliberation, Arguing."

[7] This process may involve disagreement. Alexander reports that teachers find that principle #5, making the talk cumulative, is the most difficult, as there are a lot of ideas and arguments that teachers need to keep track of while simultaneously attending to the other principles.

Alexander distinguished between *argumentation* and *discussions*, viewing them as separate categories of discourse. Specifically, discussions can serve a broader array of goals, such as exploration, creativity, etc. This distinction seems forced; we instead think of argumentation as a subcategory of discussions that encompasses critical discussions, inquiries, deliberations, etc. (van Eemeren et al., 2002; Walton, 1998). Nevertheless, we agree with Alexander that argumentation requires a different repertoire of norms and talk moves than do (other types) of discussions, although there is overlap between the two. Argumentation involves a forward momentum that other types of discussion may not require. (Some discussions might just be about sharing ideas and experiences.)

Academically Productive Talk (APT)

Alexander (2020) writes that an overall approach to dialogic teaching that aligns well with his own is the one reflected in Academically Productive Talk (APT). APT emphasizes productive talk moves, strategic talk formats, and tools for building a classroom talk culture that supports intellectual risk-taking, reasoning, and equity (Michaels & O'Connor, 2012; 2015). Michaels and O'Connor developed APT along with colleagues such as Robin Alexander (2020); Courtney Cazden (2001), and Lauren Resnick (Resnick et al., 2015, 2018). APT was influenced by, and to a large degree grew out of, the work with Resnick on "accountable talk" (Sohmer et al, 2009).

APT is most well-known for its focus on a small set of well-designed "productive talk moves" -- simple statements or questions that teachers (or students) can use to open up the conversation, position students as thinkers, and promote equitable participation and collaborative knowledge building.

These are moves made by teachers (or students) that *follow up* on student contributions and replace the "evaluation" move in the Initiation-Response- Evaluation "default" pattern of classroom talk (Cazden, 2001; Mehan, 1979). These alternative "third-turn" moves (Park et al., 2017; Scott et al, 2006) can open up the conversation, creating space for expanded student reasoning, explication of complex ideas, or critique. Examples include a "say more" move ("Say more about that?"), a revoicing move ("So, are you saying…? Do I have what you said right?" leaving space for the student to agree or not with the teacher's reformulation), and moves that press for reasoning ("Why do you think that?" "What's your evidence?") or counterexamples ("Does it always work that way?"). All these moves are designed to create space for student ideas to emerge and to be developed collaboratively and equitably and to shift the "game" from "getting the right answer" (or "doing school") to one where students are positioned as thinkers, reasoners, and collaborative knowledge builders, building on and critiquing the ideas of their peers. Here, using a different third-turn move can open up the conversation, creating space for expanded student reasoning, explication of complex ideas, or critique. Alexander calls these alternative third-turn moves "extending" moves, referring to them as "Ingredient X," the special element that can shift the conversation from "recitation to reasoning" (Alexander, 2020). Alexander based his repertoire for extending discourse with alternative third-turn moves directly on the work in APT.

The set of talk moves specified in APT have been shown to support four goals that are critical for powerful sensemaking to occur -- helping all students: (1) make their thinking public, so others can build on it, (2) listen with focus to their peers' ideas, (3) dig deeper into reasoning, evidence, models and argumentation, and (4) build on, critique, and synthesize the thinking of others so that the community can work towards shared understandings (Michaels & O'Connor, 2012, 2015, 2018; Moon et al., 2014; Reiser et al., 2017). Talk moves are tools that are relatively easy for teachers to pick up (and can be used in any content domain or grade level). But they require practice and need to be used strategically in order to foster Alexander's principles of dialogic teaching, to promote supportive, equitable, cumulative, and purposeful discussion, argumentation, and learning.

Critical Questions as Talk Moves

We propose that CQs should be considered an important subcategory of talk moves. In this way, we can join the work on academically productive talk (APT) and dialogic teaching with the CQMAA. Teachers or students can ask the CQs orally during a dialogue to press for evaluation of students' reasoning. Although CQs can be part of written discourse, such as when students are filling out a graphic organizer that contains CQs, they are nonetheless discourse moves in the dialectical evaluation of arguments. We simply expand the notion of talk to include written discourse. CQs add to the toolkit of talk moves that can help students think deeper and collaboratively (APT Goals 3 and 4) and, of course, more critically.

CQs open up a particular portion of the dialogic space, but a CQ still must be adequately discussed, and that is where the use of the other productive talk moves identified by Michaels and O'Connor (2015) and other discourse moves (see Cullen, 2003) are especially important (although some talk moves should also be used before asking CQs, for example, to elicit student ideas or foster discussion norms).

As an example of how CQs could be used during a discussion as talk moves, consider the phenomenon of lunar phases. Many students believe the Moon's phases are caused by shadows cast by the Earth (Brunsell & Marcks, 2007). As evidence, students might cite a video showing how celestial bodies block the sunlight during an eclipse, reasoning that because the Moon orbits the Earth, at some point, the Earth will block the light falling on the Moon. Using critical questions, this argument could be critiqued based on coherence, i.e., "Does the argument make a path that you can follow or are there missing steps?" (How does the Earth cast a half moon shadow, with a straight line, when the Earth is round?), the relevance and quality of the evidence ("The evidence is about eclipses, not lunar phases''), the presence of alternative models (i.e., "Do other students have different models?") and are there factors or facts that we haven't considered? (e.g., such as the orbital planes--the Moon orbits the Earth on a different plane than the Earth orbits the Sun). These critical questions can be raised by either teachers or students and should ideally result in discussions that clarify what is right or problematic about various conceptions. Throughout, the teacher should use other talk moves to make sure students listen to one another, stay on topic, fairly evaluate what is said, and summarize the conclusions reached.

This example also illustrates how the CQ categories, covering the various ways that arguments can be critiqued (structure, meaning, evidence quality, etc.), can be useful for teachers in both planning lessons and facilitating discussions. The categories can attune teachers to different areas of the "problem space" that have been or could be explored by students' discussions. Also, when facilitating a discussion, the categories are "back pocket" tools that can help teachers generate responses on the spot that can move a discussion in a potentially productive direction.

CQs fit directly into Alexander's argumentation repertoire, and he does list questions suggested by Reznitskaya and Wilkinson (2021) that contain many of the CQs that we have proposed. These questions, however, are not specifically labeled as *critical questions* or explicitly tied to the philosophical framework that we have proposed. Also, the sequence of questions is different, addressing alternative perspectives first, then clarification, then evaluation of reasons, facts, and values, and then structure and connectedness. Reznitskaya and Wilkinson's intent was not to have teachers ask these questions in a specific order, of course, nor do we suggest that our CQs should be asked in any particular order (except for the bookend questions), but the set of questions is important conceptually for teachers and students to have a coherent framework for how arguments can be evaluated systematically. Some such coherent framework (grounded in contemporary philosophical theory) is needed as an alternative to the overused, antiquated, and philosophically problematic Toulmin model (1958) or models derived from it (McNeill & Krajcik, 2006; see Nussbaum & Dove, 2022 for a critique).

To achieve the goals of a dialogue effectively, it must be emphasized that CQs and other talk moves should be used strategically, in combination with other repertoires, a dialogic stance, a supportive classroom culture, content knowledge, and Alexander's six principles. Although perhaps necessary initially to learn some of the CQs, answering CQs should not be used as just another task for students to complete but rather discussed in a purposeful manner.

Extended Example of Using Critical Questions as Talk Moves

We present one extended example of a discussion facilitator using CQs as talk moves. It is an argumentative discussion over whether taxes on gasoline should be increased to address global warming. The discussion was facilitated by the first author in a seventh-grade social studies classroom (as described in Nussbaum & Edwards, 2011). The class contained many emergent multilingual learners and was ethnically diverse. The researcher was allowed to lead a discussion of a current event in this classroom once per week. The students had read a *Newsweek* article on the topic and discussed it the prior week. At the beginning of the lesson analyzed here, students completed a graphic organizer, known as the Argumentation Vee Diagram (Nussbaum, 2008b), where they described arguments and counterarguments on the proposal, responded to five CQs, and then wrote a paragraph justifying their own position. The topic was then discussed in a whole-class discussion format with ten students participating (only the portion of the class with parental consent to take part in the research).

1	Facilitator:	Did anyone take the argument side?...Thomas, go ahead and repeat your paragraph.
2	Thomas:	The arguments are right because global warming is much important than cars. To prevent global warming we should recycle, we should take risks, and help everyone. If global warming was starting right now, few of us would die, because of drought. We need water to live because without it we can't hydrate.
3	Facilitator:	Guadalupe, want to read yours?
4	Guadalupe:	I'm not sure it will make sense to you or not.
5	Facilitator:	Why not?
6	Guadalupe:	I think arguments is stronger. It's stronger because global warming is more important than holiday presents. Like if people want presents instead of their life, they can at least help us raise money or something. Although we might not be able to raise money, people still care about the world we live in.
7	Facilitator:	So you really saying that it's more important
8	Guadalupe:	than holiday presents.
9	Facilitator:	That's a good use of that critical question.

The facilitator is here referring to a CQ related to category # 8 on trade-offs (Are any of the reasons on one side more important than those on the other?). These arguments are in favor of a carbon tax. The facilitator then tries to solicit opinions on the other side of the issue, initially unsuccessfully.

(discourse continues on next page)

10	Facilitator:	So you took the argument side too. Did anyone take the other side of this?…Anyone think the counterarguments were stronger?
11		[no response]
12	Facilitator:	No one thought the counterarguments were stronger. Don't be shy. Did anyone think of counterarguments? Anyone see any problems with the arguments or counterarguments? [pause]
13	Facilitator:	Did anyone think, let's take a vote. How many people think we should raise taxes on gasoline so people would drive less?
14	:	[Four students raise hands.]
15	Facilitator:	How many people think we should not raise taxes?
16		[Three students raise hands.]
17	Facilitator:	Dulcinea, tell me why you think we should not raise taxes.
18	Dulcinea:	We can just make a car that runs on water….They could just make it sunlight run.
19	Facilitator:	Does anyone have a question about this? Guadalupe?
20	Guadalupe:	I was going to say something about what she said. I think if we ran the cars on water, then we're wasting water. Like, we shouldn't start wasting water. We're going to die if we don't have water.
21	Thomas:	If we waste more water, there will be less water in Lake Mead [source of the region's water supply].
22	Benny:	I disagree with that. Because you can use it so it evaporates.
23	Facilitator:	Why aren't we wasting the water? It would fall back down as rain?
24	Thomas:	Yeah.
25	Facilitator:	The question I would ask, is it practical to make cars that run on water? Do we have the technology now? [Many students indicate no.] You don't think so, Guadalupe?
26	Guadalupe:	[Shakes head no.]
27	Facilitator:	Someone saw an article about cars running on water. How much would that cost? For one car?
28	Unidentified:	Hundreds of thousands of dollars.
29	Facilitator:	Hundreds of thousands of dollars.
30	Telma:	It doesn't cost that much to get a car.
31	Thomas:	I kind of disagree with that because like you had a lower price…If it's cheap, that means it's not so good.

In this excerpt, the facilitator uses CQs at several points to move the discussion forward. At Turn 23, he cannot follow the logic of Benny's argument at Turn 22, implicitly using CQ #5 regarding missing steps (an implicit revoicing move -- "So are you saying, " 'It would fall back down as rain?'"). He suggests a possible implicit premise, that evaporated water would not be wasted because it would return as rain. After confirmation by Thomas that this is what he meant, the facilitator uses a CQ from the trade-offs category (#8) to ask if the proposal to use cars that run on water is practical, and what the cost would be. The students then argued about the latter question, concluding that it would cost a lot because cheap cars would not be any good. (There was more discussion of this question that followed, which is not shown in the above excerpt.)

The CQs used by the facilitator were successful in getting the students to think more deeply and to think together, as in turns 20, 22, and 31 (two goals of APT). The class was exploring the counterargument that alternative types of vehicles that did not run-on fossil fuels could be used as an alternative to raising taxes (relating to CQ #6 on alternatives), but this option was refuted by the argument that alternative vehicles might cost a lot and were therefore not practical. The dialogic inquiry ended here because time ran out, but with more time, the class could have productively explored using solar powered cars (which a student briefly

alludes to at Turn 18) and electric powered cars, and that these alternatives are not really competitors to a carbon tax but would complement it.

Conclusion

This article has addressed some of the areas of overlap between logical assessment and dialogic pedagogy. According to contemporary philosophical theory, logical analysis and critique involve posing and discussing critical questions, which may or may not be tied to argument schemes. We have proposed a (mostly) comprehensive set of CQs. The CQs can be used as talk moves by teachers and students to promote productive discussions, especially when learning environments (1) reflect the dialogic principles espoused by Alexander (2020), (2) are supplemented by other talk moves, and (3) are used strategically and flexibly to promote the goals of the dialogue.

One issue that we did not have space to address is the overlap between the discussion norms articulated by dialogic theorists and the normative rules of critical discussions formulated by argumentation theorists (e.g., van Eemeren & Grootendorst, 1992). Another issue is how collaborative argumentation can promote deeper conceptual understanding (see Asterhan & Schwarz, 2016, and Larrain et al., 2021 for evidence), although this is hinted at in our example on eclipses. In our future work, we hope to integrate work on conceptual learning (i.e., by Minstrell, 2001, and others) into the frameworks articulated here and to develop additional tools to assist teachers in facilitating productive discussions.

Although CQs have both dialectical and dialogic features, there is tension between these two concepts. Dialectic implies movement toward some resolution between a thesis and antithesis, whereas dialogic does not necessarily require this. Specifically, Bakhtin (1981) viewed the dialogic as involving heteroglossia, or the recognition of multiple voices and perspectives, without necessarily resolving the inconsistency. However, there should be dialogue between diverse perspectives. interactions that Mayer et al. (2019) refer to as polyphonic encounters. Polyphonic encounters require recognition of all voices and dialogue between them. Now, CQs are primarily dialectical in nature, in that arguments can be defeated, and the strongest arguments are those that are ultimately undefeated (Pollock, 1987). They also reflect established academic tools and norms. Using talk for the socialization of students into established practices can be considered dialogic, but a dialogic perspective aligned more with Vygotsky than Bakhtin (Mayer et al., 2019).

Nonetheless, CQs can be used dialogically and with provisions for equitable participation in the discussion. In fact, language-minority students have been found to use CQs, such as *Why?* or *How do you know?* to better participate in dialogues dominated by language-majority students (Nussbaum, 2002). Students can also be given more agency if all their ideas are taken up in a critical discussion.

In addition, student agency can be enhanced by allowing students some input into how the CQs are written and in forming a class's collective list of CQs. For example, in the Nussbaum and Edwards (2011) study, the facilitator introduced CQs with a long list of examples and gave students an opportunity to voice which ones they thought should be placed on a graphic organizer. Students were also allowed to articulate additional CQs during a discussion, such as "Who will pay for it?" There is a connection to Vygotsky as well as Bakhtin here. As Wink and Putney (2002) point out, "Vygotsky theorized that through dialogic and collaborative practices, learners personally reformulate a problem and then formulate a possible solution in their own words" (p. 102). The problem of how to critique arguments can become a collaborative one.

The Critical Question Model of Argument Assessment (Dove & Nussbaum, 2018) provides a philosophically grounded framework for critiquing arguments. CQs are primarily for the critique, not the

construction, of arguments, but they can contribute to the formulation of counterarguments and the discursive and dialectical improvement of arguments. By using CQs as teacher talk moves, teachers can model their use for students and then guide students, both individually and collectively, in the construction of better arguments.

Understanding the contribution of argumentation theory to dialogic pedagogy, however, has been hampered by the widespread use of the Toulmin model (1958) and a misperception that it is the dominant philosophical model of argumentation used in philosophy. Nothing could be further from the truth. The Toulmin model is not dialogic in nature, nor does it articulate standards for how to evaluate arguments properly. Nevertheless, its widespread use outside of philosophy has tended to obscure other productive ideas in argumentation theory from dialogic theorists, especially the work on critical questions and argument schemes. Dialogic pedagogy and argumentation theory have operated in separate silos for the most part, although there are some exceptions (e.g., Anderson et al., 1997; Lipman, 1988). The idea of using CQs as talk moves, while practically important, is also a theoretically important step in bringing together philosophical perspectives on logic and argumentation with sociocultural and sociohistorical ones (e.g., Alexander, Bakhtin). Hopefully, the dialogue between these two different scholarly traditions will be productive.

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