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REVIEW ARTICLE

KReC-MD: Knowledge Revision with Multiple Documents

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Abstract

The aim of this paper is two-fold. The first aim is to review the core representational and processing aspects of influential accounts of single-document and multiple-document comprehension with a particular emphasis on how readers negotiate conflicting information during reading. This review provides the groundwork for the second aim—to expand our current account of knowledge revision during reading of *single documents* to *multiple documents*. The product of this expansion is an initial conceptualization of the Knowledge Revision Components Framework–Multiple Documents (KReC-MD). This initial conceptualization presents the theoretical foundation necessary for future empirical work and further refinement.

Keywords Knowledge revision · Multiple-document comprehension · Misconceptions reading comprehension

We live in an Information Age that provides readers with unprecedented access to information. Due to the lack of traditional editorial control and gatekeeping, readers will inevitably encounter various forms of information that can reactivate pre-existing misconceptions or inaccurate prior knowledge (Kendeou et al., 2020; Wardle & Derakhshan, 2017). Moreover, because the current information ecosystem includes multiple perspectives regarding a host of socio-scientific issues (e.g., vaccination, climate change, genetically modified organisms), readers are likely to encounter information that conflicts with their prior knowledge repeatedly across multiple documents from different sources. One critical consequence of this exposure is that readers' misconceptions may become even more difficult to correct (Shtulman & Valcarcel, 2012). To make matters worse, existing literature in education, psychology, and communication sciences points to an incomplete understanding of the complex processes involved in correcting or revising misconceptions (Chan et al., 2017; Cook et al., 2015;

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Kendeou et al., 2019b; Lewandowsky et al., 2012; Rapp & Braasch, 2014). Given this complexity, it is critical to gain a deeper understanding of how readers effectively learn in an information ecosystem increasingly characterized by multiple representations and perspectives of information (Van Meter et al., 2020).

The overarching aim of the current paper is to propose an initial account of a key phenomenon with respect to learning in the Information Age—*how readers revise their misconceptions when they confront multiple documents from multiple sources*. To do so, we review existing theoretical accounts from two key strands of literature. The first strand is multiple-document comprehension. Specifically, we review the models and frameworks that have expanded our understanding of how readers process and represent information in single documents to how readers process and represent information from multiple documents. In the current paper, we define a "document" as a written text from a single source created with the purpose of providing information about some state of affairs in the real world; thus, "multiple documents" refers to sets of written texts associated with distinct sources (Britt & Rouet, 2020). The purpose of reviewing this literature is to inform our understanding of how the representational, processing, and conflict-based aspects of extant accounts of comprehension could be leveraged to account for knowledge revision in multiple-document contexts.

The second strand of literature we review regards the revision of readers' misconceptions. For this strand, we focus on extant theorizing and empirical evidence regarding *knowledge revision*, defined as the incremental reduction in activation of the reader's misconceptions (Kendeou & O'Brien, 2014). In this context, we define a *misconception* as reactivated prior knowledge at the individual-belief level (Chi, 2009) that is inconsistent with the current normative scientific consensus (for a discussion of knowledge revision versus *conceptual change*, see Kendeou et al., 2017). With respect to this strand of literature, we review our extant account of knowledge revision, the Knowledge Revision Components Framework (KReC; Kendeou & O'Brien, 2014). The purpose of reviewing this literature is to inform our understanding of how the component principles of KReC could be updated and expanded to provide an account for revision in multiple-document contexts.

The review of these two strands of literature provides the necessary groundwork to propose expansions to KReC's principles and account for knowledge revision in multiple-document contexts. We call this expanded account the Knowledge Revision Components Framework-Multiple Documents (KReC-MD). Importantly, KReC-MD is proposed as an update and expansion of KReC, as opposed to a *successor* that marks KReC's obsolescence. We contend that offering companion accounts of knowledge revision in both single-document and multiple-document contexts contributes to a more comprehensive theoretical landscape. This is because engaging with single documents that conflict with prior knowledge remains a relevant and complex phenomenon, yet our current information ecosystem forces readers to engage with multiple documents, which introduce more complex processes and representations that KReC cannot account for in its current form. It is also critical to emphasize that KReC-MD is not a *new* account of multiple-document comprehension *per se*, as it does not propose new specifications for how readers engage with and understand multiple documents generally. Instead, KReC-MD draws from existing aspects of multiple-document comprehension in order to propose how knowledge revision could unfold in multiple-document contexts.

It is critical to expand our understanding of knowledge revision to account for multiple documents with KReC-MD for several reasons. First, readers are consistently confronted with multiple documents from various sources, particularly in unregulated online environments (e.g., Cho & Afflerbach, 2015; Kobayashi, 2014). Second, engaging with multiple documents

compounds the complexity of the reading situation because multiple documents may vary not only in the source of the documents but also coherence, cohesion, accuracy, and intent (Britt & Rouet, 2020). Third, engaging with multiple documents or sources that reactivate misconceptions is a relevant phenomenon that can advance our understanding of the conditions that can facilitate or impede revision in more authentic environments. Take, for example, online "filter bubbles" and "echo chambers" (Del Vicario et al., 2016), where readers encounter multiple documents from multiple sources that converge on a singular view of contentious socio-scientific domains about which readers hold highly consequential misconceptions (e.g., vaccines, climate change). Thus, the initial specification of KReC-MD has the potential to advance our understanding of how readers may effectively learn accurate information in the context of a complex information ecosystem that confronts them with information that reactivates their misconceptions.

Multiple-Document Comprehension: Representation, Processing, and Conflict

In this section, we discuss prominent models and frameworks relevant to multiple-document comprehension (i.e., the Documents Model Framework, Perfetti et al., 1999; the Reading as Problem Solving Model, Rouet et al., 2017), as well as sourcing during reading (i.e., the Content-Source Integration Model, Stadtler & Bromme, 2014; the Discrepancy-Induced Source Comprehension Model, Braasch & Bråten, 2017). For each model, we include key representational and processing aspects and discuss how readers cope with conflicting information. Understanding how existing models and frameworks of multiple-document comprehension account for reading situations in which readers experience cognitive conflict is critical for extending our current understanding of knowledge revision. However, this is not to say that contending with cognitive conflict is the sole challenge of knowledge revision. Indeed, several reader-level factors, such as the breadth and depth of prior knowledge, the strength of misconceptions reactivated from prior knowledge, and readers' goals and purpose for reading are a few examples of core determinants for the success or failure of knowledge revision. There are also a host of text-level factors that are critical to consider as well, many of which are compounded in multiple-document contexts. These include perceived source credibility, text structure and cohesion, and quality of the explanatory information in the documents. Although each of these factors is important and deserves attention in its own right, encoding information that conflicts with prior knowledge and coping with resulting cognitive conflict is a necessary precondition for knowledge revision processes to unfold, regardless of the reading situation. For this reason, we focus specifically on this aspect in our review and discussion of these models.

Many of the models included in this review can be thought of as cumulative in that they represent successive extensions of a prominent model of single-document comprehension—the Construction-Integration (CI) model (Kintsch, 1988). Thus, we first discuss the CI model. Doing so provides foundational information about the representational and processing aspects that informed subsequent accounts of multiple-document comprehension and sourcing and are likewise integrated into KReC-MD.

Construction-Integration Model

The CI model (Kintsch, 1988) is often considered the best approximation of a true "theory" of text comprehension (Kendeou & O'Brien, 2018; McNamara & Magliano, 2009), which may

be one reason the model has served as the foundation for many subsequent models and frameworks of multiple-document comprehension and sourcing. The first phase of the model, *construction*, refers to the activation of information from the text and prior knowledge from the reader's long-term memory. This activation is "dumb" in that it operates on both information that is relevant to the current discourse situation and information that is irrelevant. The second phase of the model, *integration*, captures the spread of activation across the interconnected network of information. Information that has low activation as processing unfolds is unlikely to be maintained in the evolving mental representation of the text.

Representational Aspects Both the construction and integration processes rely on prior knowledge (Kintsch, 1988) in the form of an associative network of interconnected nodes generated in the context of the reading task. A critical aspect of the CI model is the assumption that information in texts is represented at three levels. The first level is the surface code, which represents the actual words in a text. The second level is the textbase, which includes all of the information that was reactivated during the construction phase. Because initial activation and elaboration is sloppy, the textbase is an enriched, albeit incoherent and contradictory representation. The third level is the situation model, which captures the overall meaning of information in the text after its integration with prior knowledge.

Processing Aspects The construction phase captures the process of encoding and reactivating information to construct a textbase. This process involves forming concepts from linguistic input, elaborating each of these concepts by reactivating related contents within the associative network, and inferring additional information. What has been constructed at this point is a set of concepts or propositions derived from the text, as well as a set of associates for each concept. The result is a network that consists of all the concepts and their elaborations that have been formed and inferences that were generated at both the local and global level.

The network that results from the construction process is not an accurate representation of a text because it was sloppily constructed and therefore contains inconsistencies. Fortunately, an iterative integration process increases activation of more heavily connected and relevant concepts, which comes at a cost of activation for concepts with fewer connections. The integration process is iterative in that readers construct a new network during each processing cycle or sentence. If this integration process fails, then new concepts are added to the network and spreading activation continues. If the process continues to fail, then the reader may engage in problem-solving processes to attempt to restore coherence.

How is conflict handled? Within the context of the CI model, the sloppy activation processes that occur during the construction phase often result in a network that contains incoherent or conflicting information (Kintsch, 1988, 1998). However, as Kintsch (1998) noted, the price of this sloppy activation is relatively inconsequential. Because of the connectionist nature of the network, weakly connected information is unlikely to be maintained in the network during spreading activation and will thus fail to be incorporated into the situation model of the text. In essence, the CI model posits that relevant information accumulates activation at the expense of irrelevant or inconsistent information (see McNamara, 1997; McNamara & McDaniel, 2004). This assumes that the inconsistent information, due to relatively fewer interconnections with other information in the network, is not important for the macrostructure of the text. For example, McNamara (1997) used a CI simulation to show that greater activation of relevant

prior knowledge was associated with greater suppression of the irrelevant meaning of ambiguous words during sentence comprehension.

The nature of the "conflict" in investigations of the CI model may differ somewhat from the type of cognitive conflict that arises when readers encounter information that is inconsistent with their prior knowledge. Namely, the conflict in the context of the existing literature on CI is a byproduct of sloppy activation during reading of texts that contain lexical or semantic ambiguities but have a single "correct" interpretation. Thus, the CI model does not explicitly account for how readers resolve conflict in discourse situations in which conflicting information serves a critical role in the text itself (i.e., two conflicting perspectives on an issue). Kintsch (1988) did note that the CI model was conceptualized with relatively general representational and processing rules to evade the need to fine tune the model to ever-changing discourse contexts. This is a strength of the model, as these rules are flexible. In addition, Kintsch does leave the possibility that readers may need to engage in top-down processes like reinstatement searches and problem-solving, which could be a reasonable response to the sort of conflict that occurs if routine bottom-up processes fail when readers encounter information that is inconsistent with prior knowledge.

The Documents Model Framework

There are several critical reading contexts that cannot be explicitly accounted for by the CI Model or other accounts of single-document comprehension. Specifically, as Perfetti et al. (1999) noted, CI does not capture contexts in which multiple representations of the same situation are presented across multiple documents. Namely, separating the semantic representation of a single document from the situation it describes is difficult; however, as Perfetti et al. (1999) noted when proposing the Documents Model Framework (DMF), engaging with multiple documents that introduce variation in how that situation is described enables a distinction between documents and the situation described therein (Britt & Rouet, 2020; Perfetti et al., 1999). This distinction is increasingly critical given the demands that information consumers face today in an unregulated information ecosystem (e.g., Britt et al., 2019), such as engaging with distinct documents offering different perspectives on the same situation, or documents corroborating one another but conflicting with the representation of the situation in the reader's prior knowledge (Strømsø, 2017).

Many of the key hypotheses regarding multiple-documents comprehension originated from work on engagement with document sets about historical controversies (e.g., Wineburg, 1991). Results from this work have shown that readers' representations of multiple documents may include key information about the documents themselves (i.e., the type of document, primary vs. secondary source), the authors' identity, and any other information that can be used to connect pieces of information to respective sources (e.g., Britt et al., 2018a; Rouet et al., 1996). Indeed, reading multiple documents compounds the complexity inherent in text comprehension because multiple documents introduce variation in factors like cohesion, overlap among semantic content, and credibility of sources (Braasch et al., 2016). This added complexity has prompted researchers to propose theoretical accounts of multiple-document comprehension, beginning with the Documents Model Framework (Perfetti et al., 1999).

Representational Aspects According to the DMF, there are several ways in which a reader can represent information accessed through engagement with multiple documents (Britt et al.,

1999). First, readers may construct separate representations of each document that have no connections among them. Second, readers may construct a "mush model" in which information that is common among the various texts is integrated without regard to source information. Third, readers could construct a "tag-all" model in which all information from every text is tagged with its respective source, but this would come at a very high cognitive load (Britt et al., 1999). The final possibility is the documents model, which accounts for how skilled readers form mental representations of multiple documents and their sources.

The documents model consists two core components. The first is the *intertext model*, which captures the relations among documents and among a document and elements of the situation described in the document set. The second is the *situations model* (see also Britt et al., 2018b), which represents situations described in the texts broadly (i.e., both real situations and hypothetical ones). When the situations model and the intertext model are interconnected, an integrated *documents model* is represented.

The intertext model consists of a node for each document and links between documents and the situation(s) described. Consistent with the CI model, each node contains slots for source, rhetorical goals, and content. Slots will be filled if the sources are discriminable, cognitive demands are reasonable, and knowledge of the source and the reading situation is sufficient. Source nodes may include a range of source information, like author identification variables (e.g., author's name, credentials, motivation), setting information variables (e.g., setting, time), and document form variables (e.g., language style, document type). Document nodes also contain variables related to the document's rhetorical goals (e.g., intent of document, intended audience), which are typically not stated and must be inferred from prior knowledge. Additional elements of the intertext model are intertext predicates. Intertext predicates represent the relations among documents (e.g., "agrees with X/opposes X") and between a document and a situation model event.

The second core component of a documents model is the situations model. A situations model represents the reader's mental representation of some real or hypothetical world presented by the texts. However, multiple texts may present multiple situations or multiple perspectives on the same situation. The need for a documents model becomes more obvious if a reader engages with multiple texts about the same situation. If each text were presented in isolation, then a simple causal-temporal network would suffice as a mental representation. However, when texts present conflicting causes for the same situation, event, or topic, the reader must resolve the contradiction. The simplest way to do so would be to build separate causal-temporal networks for each text. However, this would defeat the purpose of engaging with multiple texts (i.e., to acquire a coherent understanding of some situation) and would likely result in a relatively impoverished mental representation.

Processing Aspects Perfetti et al. (1999) acknowledged that the DMF is primarily a representational framework, which leaves the processing assumptions with relatively fewer specifications. However, the authors adopt and expand on the situation model (e.g., Kintsch, 1988) in the form of a situations model as a product of reading comprehension. In doing so, the authors also adopt, at least implicitly, the processing assumptions of the CI model. Thus, information from *multiple* documents sloppily reactivates information from other documents, previously read information from within a document, and information from prior knowledge to construct an interconnected network. However, in addition to the nodes and links described by the CI model, the DMF also proposes new nodes and links. Specifically, the DMF proposes document nodes and intertext links that can connect sources to other sources (i.e., source-

source links) and sources to situations described in the documents (i.e., source-content links). Then, during integration, activation spreads throughout this network, and concepts that have many connections are maintained and those that have fewer are eliminated.

How is conflict handled? The DMF proposed that contradictory information resulting from multiple perspectives may motivate readers to represent and evaluate information about the sources as a means to represent conflicting information coherently. In other words, the DMF proposed that readers may restore coherence by attributing conflicting information to multiple perspectives (Perfetti et al., 1999). Drawing from this aspect of the DMF, Braasch et al. (2012) posited the Discrepancy-Induced Source Comprehension (D-ISC) assumption. According to D-ISC assumption, readers use source information as a representational framework when they encounter discrepancies in text. This use of source information allows readers to restore coherence by attributing an inconsistency to different perspectives. The D-ISC assumption served as the basis for the D-ISC model (Braasch & Bråten, 2017) which emphasizes the *processes* by which readers establish global coherence when engaging with discrepancies, either within a text or across multiple texts or documents. Namely, when readers encounter a conflict or discrepancy, they shift to more strategic processing. This strategic processing is aimed toward encoding source information and evaluating the trustworthiness of the claims from those sources. This increased attention to sources and the information presented from each source encourages the construction of document nodes and strengthens source-content links in the reader's mental representation of the texts. Consequently, these source-content links can be used as a means to organize the mental representation of the conflicting information (Braasch & Bråten, 2017), which is helpful given that readers typically encounter problems when they use semantic content alone to resolve conflicts (e.g., Chinn & Brewer, 1998; Hakala & O'Brien, 1995).

Another model that directly draws from the DMF to propose how readers deal with conflicting information is the Content-Source Integration (CSI) model (Stadtler & Bromme, 2014). CSI articulates several stages of processing conflicting information, including conflict detection, conflict regulation, and conflict resolution. The first processing phase, *conflict detection*, brings an awareness that two or more propositions are incoherent (Stadtler & Bromme, 2014). This would incite the reader, depending on his or her level of domain expertise, to actively check for information consistency (i.e., corroboration, Wineburg, 1991). The second phase is *conflict regulation*, which involves restoring coherence after conflict detection. Readers can ignore the conflict, reconcile the conflict, or accept the conflict as a consequence of different sources. Ignoring the conflict is the simplest means of restoring coherence but may result in an impoverished mental representation. Reconciling or choosing between conflicting propositions is likely to occur when the conflict is relevant to the reader's goals and when explanations are available to the reader. Finally, readers may accept a conflict as due to different sources. This is done when readers cannot ignore or reconcile a conflict. In this case, readers interpret the coherence disruption as a function of different perspectives rather than a genuine coherence break (Strømsø et al., 2013). The third phase is *conflict resolution*. Resolving a conflict requires the reader to develop a personal stance toward the conflict via validity judgments as a result of firsthand and/or secondhand evaluations of truth value. Firsthand evaluations involve assessing the validity of claims based on prior knowledge and occur automatically so long as readers possess relevant prior knowledge (Richter et al., 2009). Secondhand evaluations involve evaluating the validity of claims based on source information. This evaluation occurs primarily when firsthand evaluations fail.

It is important to note that several theoretical accounts of multiple-document comprehension have been developed following the DMF. The Multiple-Document Task-based Relevance Assessment and Content Extraction (MD-TRACE; Rouet & Britt, 2011) outlines a general sequence of processes that readers may perform when engaging with multiple texts for the purposes of completing an overarching reading task. The Cognitive Affective Engagement Model of multiple source use (CAEM; List & Alexander, 2017) focuses on how readers' level of affective engagement and text evaluation skills (i.e., their default stance) influence several important multiple-text behaviors like text selection and information access. The Integrated Framework of Multiple Text use (IF-MT; List & Alexander, 2019) builds on these earlier models to conceptualize students' multiple text use over the course of three stages: preparation, execution, and production.

These accounts represent the complexity inherent in engaging with and comprehending multiple documents, including the task, topic, and question that are typically outlined prior to reading; the selection, engagement, and navigation of documents that occur during reading; and the production of some output, often in the form of a written product, which occurs after reading. Moreover, the aforementioned accounts underscore the role of readers' representations of the task and goal may play in learning from multiple documents, but research into such task conditions and contextual variables is relatively nascent (Britt & Rouet, 2020).

The RESOLV Model

The Reading as Problem Solving model (RESOLV; Britt et al., 2018b; Rouet et al., 2017; Rouet et al., 2017) is a recent account of multiple-document comprehension that broadens our understanding of the factors and conditions related to the reading task and their interplay with document engagement and post-reading outcomes. RESOLV expands on the representations of the DMF to account for the role of the reading context and representation of the reading task, which drives their goals and, in turn, their decisions regarding document engagement and processing. In all, RESOLV offers a comprehensive framework for understanding the top-down, strategic skills involved in learning from multiple documents.

Representational Aspects RESOLV assumes that reading takes place within a physical and social context, which includes five core dimensions: (1) the request or need for reading, (2) the requester, (3) the audience, (4) supports and obstacles, i.e., available information sources, and (5) the reader's assessment of self as a cognitive and social agent. According to RESOLV, readers construct a mental representation of their physical and social context that precedes and surrounds the reading experience (i.e., *context model*). The construction of the task model is centered around the request or purpose for reading and involves reactivation of preexisting schemata, pattern matching, and feature extraction. The task model also includes some features that serve to constrain the reading request, such as time constraints and availability of external resources (e.g., texts). Based on the context model, the reader also constructs a highly dynamic mental representation of the end goal of the reading activity and the means by which the reader may achieve that goal (i.e., *task model*). The reading activity is seen as a sequence of processes, decisions, and actions that are selected through benefit–cost analysis in the service of reader-generated goals. The task model emphasizes the reading *processes* by which readers engage with the reading task in order to achieve reading goals.

Processing Aspects In the context of RESOLV, the reader selects prominent cues from their context models to interpret and understand the request and reading setting, establish reading

goals, and detect and handle obstacles and impasses during document engagement. The reading goals drive decisions and behaviors regarding what sources to read and how to engage with them. Decisions about whether, how, and to what extent to engage with sources are based on whether the benefit-cost ratio reaches some decision threshold, which depends on reader-level factors like skill, interest, and self-concept as a reader. The activation level required for readers to engage in adaptive reading behavior may be adjusted based on the reader's perceptions of utility, or whether the reading behavior will help achieve the reading goals. Moreover, the reader's understanding of desirable reading outcomes drives the extent to which the reader may engage in effortful processing of the sources, as well as post-reading assessments of the extent to which information is useful.

How Is Conflict Handled? Conflicting information within the reader's mental representation could be considered an obstacle or *impasse* in the context of RESOLV. RESOLV posits two nonroutine decisions that may unfold when readers encounter an impasse. If the reader is engaged and motivated, RESOLV proposes that the reader may engage more deeply with their external resources (i.e., re-read or re-interpret the texts), or adjust their reading goal (i.e., readers may feel compelled to decide which side of a controversy or inconsistency they believe). In essence, conflicting information may compel the reader to revise their representation of the reading situation, which in turn would lead to an updated representation of the reading task and therefore goal of engaging with the documents.

Knowledge Revision: When Text(s) Conflict with Prior Knowledge

We define knowledge revision as the incremental reduction in activation of the reader's misconception from prior knowledge relative to a newly encoded correct idea. Knowledge revision has been systematically examined in the context of refutation texts. A refutation text states and reactivates a target misconception, directly refutes it, then provides an alternative, correct idea along with a causal explanation to support the correct idea (e.g., Sinatra & Broughton, 2011). In this context, experiments have used a reading-time methodology to show that disruptions in comprehension due to reactivated misconceptions (indicated by reading time slowdowns on target sentences that conflict with the reader's prior knowledge) are reduced when readers encode causal explanations that support the correct idea, suggesting that the activation of the misconception has been reduced (e.g., Butterfuss & Kendeou, 2020; Kendeou et al., 2014; Van Boekel et al., 2017). Moreover, existing research has used a think-aloud methodology (e.g., Kendeou et al., 2019a; Trevors et al., 2017) to show that the correct explanation reduces cognitive conflict readers experience from reactivation of misconceptions. As we discuss next, Kendeou and O'Brien (2014) developed the Knowledge Revision Components Framework (KReC) to identify the conditions that facilitate the reduction in activation of readers' misconceptions during engagement with refutation texts.

The Knowledge Revision Components Framework

KReC outlines a set of assumptions and conditions that must be met for knowledge revision to occur. The crux of KReC is the competing-activation mechanism, in which the reactivated misconception and the newly encoded correct information from a refutation text compete for

activation. Knowledge revision is successful when the activation of the correct information overcomes activation of the misconception, thereby resolving cognitive conflict. Each of KReC's principles is briefly reviewed below and then discussed more comprehensively when we propose modifications and expansions of each of KReC's principles so that they may account for the added complexity of engaging with multiple documents.

Representational Aspects Like other discourse frameworks reviewed here, a core assumption of KReC is that knowledge is organized in a network of interconnected nodes. Nodes consist of concepts or propositions, and links represent the relations among these concepts (e.g., Kintsch, 1988; Myers & O'Brien, 1998). Incoming information serves to passively reactivate previously read information and prior knowledge from memory. Reactivated contents, as well as newly encoded information, can then become integrated into one network. Moreover, as readers encode more information related to a particular concept, the structural richness surrounding that concept is assumed to increase, which enables that concept to dominate the network. Specifically, Kendeou and O'Brien (2014) explained that, as readers encode the causal, interconnected explanation from the refutation text that supports the correct idea, they construct a rich causal network of that information.

Processing Aspects KReC consists of five principles that account for knowledge revision as readers engage with a refutation text. The first two principles consist of core assumptions (*encoding* and *passive activation*), and the remaining three principles describe conditions and the mechanism of knowledge revision (*coactivation*, *integration*, and *competing activation*). The *encoding* principle assumes that information that has been encoded and stored in long-term memory cannot simply be erased or replaced and therefore has some potential to be subsequently reactivated; this assumption was adopted from global models of memory (Gillund & Shiffrin, 1984; Hintzman, 1986; Ratcliff & McKoon, 1988) and is consistent with existing models of comprehension (e.g., the CI Model, Kintsch, 1988). The *passive-activation* principle assumes that information in long-term memory can be reactivated via passive processes (Myers & O'Brien, 1998; O'Brien & Myers, 1999). Specifically, incoming information serves as a signal to all of long-term memory, and long-term memory contents that resonate with that signal as a function of featural overlap become reactivated. Importantly, this reactivation can unfold regardless of whether memory contents facilitate or interfere with comprehension processes.

If misconceived knowledge cannot simply be erased and has some potential to be reactivated and disrupt processing, then how can knowledge revision be achieved? The remaining three principles of KReC specify the conditions and mechanism that serve to reduce the activation of misconceptions. *Coactivation* is necessary for knowledge revision because both the new information and misconception from prior knowledge must be simultaneously activated (Kendeou et al., 2011; Kendeou & van den Broek, 2007; van den Broek & Kendeou, 2008). Next, the *integration* principle contends that revision can only occur after the newly encoded information becomes integrated with the misconception (e.g., Kendeou & O'Brien, 2014; Kendeou et al., 2014). Integration enables the mechanism of the revision process, *competing activation*, to unfold. As the amount of newly encoded information (i.e., causal explanation from the refutation text) increases, the causal network of that information will begin to dominate and draw activation to itself and simultaneously draw activation away from the misconception. If sufficient activation is drawn from the misconception, any disruption it imposes can be reduced or eliminated (see also McNamara & McDaniel, 2004).

How Is conflict handled? The crux of the KReC framework is the competing activation mechanism. After the newly encoded information becomes integrated with the misconception from the reader's prior knowledge, the two concepts in memory are bound into one memory representation. This means that activating one concept is expected to passively reactivate the other concept, regardless of whether it is correct or relevant. When the text provides an interconnected explanation that supports the correct idea, these interconnections increase the richness of the nodes surrounding the correct idea in the causal network. In doing so, the correct idea draws increased activation to itself, and because activation is a fixed cognitive resource, activation is simultaneously drawn away from the misconception, thereby reducing interference induced by the conflict between the misconception and correct idea (Kim et al., 2019; Kendeou & O'Brien, 2014).

Competing activation may not always be sufficient for knowledge revision to occur, especially in cases when there is no refutation or explanation of the reader's misconception. In such cases, recent work has shown that top-down processes may become necessary. For example, inhibition of prepotent responses may assist readers in suppressing interference from co-activated, conflicting concepts. Kendeou et al. (2020) found that readers who had higher inhibition (as indicated by the Stroop task; Stroop, 1935) demonstrated slower reading times compared to lower-inhibition readers on target sentences that served to reactivate misconceptions during reading of non-refutation texts (i.e., texts that did not contain refutations and explanations). This relative slowdown in reading time may suggest that high-inhibition readers were engaging in problem-solving or metacognitive processes (see also Kendeou et al., 2019a, 2019b) aimed at resolving the conflict in the absence of a refutation and explanation of the misconception.

Although KReC's principles can account for knowledge revision processes and outcomes when readers engage with single refutation texts, the introduction of multiple documents requires updates to these principles. Next, we draw on the research reviewed above in order to propose how KReC's principles could account for the complexities imposed by multiple documents. In doing so, we outline an initial proposal of KReC-MD. Then, we subsequently use this initial proposal to describe how several key factors could influence KReC-MD when a reader engages with multiple refutation texts about a single topic.

Extending KReC to Account for Multiple Documents: The Knowledge Revision Components Framework–Multiple Documents

In this section, we propose an initial conceptualization of Knowledge Revision Components Framework–Multiple Documents (KReC-MD). To do so, we draw from the existing research reviewed thus far to propose how KReC's principles may be modified in order to account for knowledge revision when readers engage with multiple documents. It is important to emphasize that the following modifications of KReC's principles are necessary for an initial conceptualization of KReC-MD, but they are not sufficient to account for the range of knowledge revision instances that may occur during multiple-document comprehension. Indeed, the principles in KReC—and therefore KReC-MD—rely largely on bottom-up, automatic processes to account for the incremental reduction in activation of readers' misconceptions. Although the line between automatic and strategic processes is rather elusive (e.g., Kendeou & O'Brien, 2018), this initial proposal of KReC-MD offers the *minimum*

specification necessary to account for primarily bottom-up revision processes. We anticipate that this initial conceptualization, no matter how limited, will stimulate further research into the reading situations, text conditions, and reader-driven processes that can arise during reading of documents that reactivate readers' misconceptions.

The Encoding Principle

The encoding principle captures the assumption that information that has been encoded into long-term memory leaves a durable trace that cannot simply be erased or overwritten, although it is susceptible to interference or decay (e.g., Gillund & Shiffrin, 1984). Because information in long-term memory cannot simply be erased, it has potential to be reactivated. This can happen even when the information interferes with comprehension and even when the reader knows the information is incorrect.

In KReC-MD, readers encode information from and about different sources. Consistent with D-ISC's proposal that readers devote greater attention to source information when they encounter a discrepancy during reading (e.g., Braasch et al., 2012), in KReC-MD, readers may be likely to encode source information given that they encounter a discrepancy in the refutation text (or are explicitly instructed to attend to source information; Van Boekel et al., 2017). Thus, in extending the encoding principle to account for multiple documents, readers are expected to attend to and encode source information during reading of refutation texts because of the discrepancy inherent in the refutation of the reader's misconception. The more explicit the discrepancy, the stronger the encoding of source information is expected to be, which has been shown to increase memory for sources after reading (Saux et al., 2017) and influence conflict resolution after reading in opinion essays (Kobayashi, 2014).

The Passive Activation Principle

KReC adopted passive activation processes from global models of memory to account for how inactive information becomes reactivated (e.g., Gillund & Shiffrin, 1984). These resonance processes are passive and unrestricted, and therefore any information that is related to currently active contents may also become reactivated.

In KReC-MD, passive activation is expected to function in much the same way it does in single-document contexts. One key difference, however, is that with multiple documents, readers may integrate source nodes (Perfetti et al., 1999) into the network of information through which activation spreads. Because source information and document information that comprise the nodes are represented, this information may be subject to passive activation in the same way as semantic content from texts and prior knowledge are. This may be especially true for high-knowledge readers or if the documents explicitly include the source information within the content of the text (as opposed to merely leaving source information as metadata about the document, Strømsø, 2017), as low-knowledge readers have demonstrated inattention to such document metadata (e.g., Wineburg, 1991). Alternatively, because passive activation alone may be insufficient to account for reactivation and integration of source information (Bråten et al., 2016; Strømsø et al., 2013), readers may need to shift their attention to the evaluation of source information. The need for source evaluation may be quite likely in this context if readers detect a discrepancy between the documents and their prior knowledge (Braasch & Bråten, 2017; Braasch et al., 2012).

Information that is common among authors of multiple documents may be strengthened, and thus may have a lower threshold for passive activation than information that only occurs in

one document within a document set. However, because content integration across texts can hurt source memory (e.g., Braasch et al., 2016), in cases of high integration of content across documents, it may be more difficult to attribute shared information to any one source in the documents model due to weaker intertext links.

The Co-Activation Principle

The co-activation principle does not change substantially between KReC and KReC-MD. Co-activation of the misconception from prior knowledge and the newly encoded correct information from the texts is the result of the passive activation processes described above. Co-activation is the necessary precondition for knowledge revision because it is the sole way that new information comes into contact with the misconception. Co-activation as a precondition for integration and represents a unique aspect to KReC in that it is not explicated in existing models of comprehension (i.e., CI, Kintsch, 1988). In the case of KReC-MD, however, readers may have multiple, conflicting accounts of a situation they constructed from multiple documents activated simultaneously. Once this occurs, the two (or more) conflicting concepts can become integrated into a single network, which is also necessary for competing activation to unfold (see below).

The Integration Principle

Unlike the preceding principles, the integration principle changes markedly between KReC and KReC-MD. In both single-document and multiple-document contexts, if the correct idea and the misconception do not become integrated into the same network, revision cannot occur given that spreading activation occurs throughout this integrated network. The nature of this network changes for KReC-MD to account for the representational complexities of multiple documents. Specifically, because integration now spans across multiple documents, we integrate the representational aspects of the DMF (Perfetti et al., 1999) to provide the structure of the reader's integrated network. Thus, this network includes an *intertext model* of the refutation texts (i.e. document nodes) and embedded sources within those texts, as well as a *situations model* that captures the reactivated misconceptions the texts address and the correct explanations the texts provide that constitute KReC's causal network. If the intertext model and the situations model become interconnected via intertext links, then an integrated *documents model* has been constructed from multiple refutation texts.

It is important to note that certain kinds of tasks have been shown to enhance integration of information across multiple documents. Namely, tasks that encourage readers to develop a personal opinion and interpretation of information found in multiple documents (e.g., argumentative or persuasive essay-writing tasks) have been shown to facilitate stronger integration than tasks require merely retelling or summarizing information (e.g., List et al., 2019; Wiley & Voss, 1999).

The Competing-Activation Principle

The most important distinction between KReC and KReC-MD lies in how competing activation unfolds. According to KReC, as the amount of newly encoded correct information in readers' integrated network increases, it will start to dominate the network. As the correct information begins to dominate the network, that portion of the network will begin drawing

increased activation to itself, and consequently, the misconception loses activation. As activation is drawn away from the misconception, the interference it induces is reduced. The competing-activation mechanism is critical to KReC because existing models of discourse comprehension do not explicitly account for how readers resolve conflict induced by co-activating ideas that are in direct contradiction with one another.

The added complexity of engaging with multiple documents from multiple sources requires KReC-MD to specify additional conditions to account for competing activation. Namely, KReC simply claims that readers encode correct information as they read an explanation in a refutation text. However, with multiple documents, instead of a single explanation from a single source supporting a single correct idea, there may be multiple explanations that address several individual misconceptions within a domain. If the documents are sufficiently related, either by high semantic overlap or explicit references to one another, these misconceptions could reactivate a *global* misconception. This global misconception represents a higher-level misconception that underlies the related individual misconceptions addressed in each of the documents. For example, if a reader holds the individual misconceptions that *vaccines cause autism*, that *vaccines contain toxic ingredients*, and that *vaccines frequently cause side effects* (e.g., Shelby & Ernst, 2013; Trevors & Kendeou, 2020), it is reasonable to assume that the reader also holds a higher-level, more global misconception that *vaccines are dangerous*.

In the context of KReC-MD, a reader could engage with a set of three refutation documents that refute and explain misconceptions. Within this set, each document could address one of the specific vaccine misconceptions. Taken together, the misconceptions—each of which relates to vaccines and thus share semantic overlap—could reactivate the global misconception. Revision of the global misconception—over and above revision of the individual misconceptions directly addressed in the documents—can be seen as the goal of revision and the ultimate outcome of competing activation in multiple-document contexts. Critically, the explanations provided in each of the refutation texts are also expected to yield a corresponding global correct idea (i.e., *vaccines are safe*). The global correct idea and the global misconception will compete for activation, and whichever idea has garnered more connections or links within the readers' multiple-document representation is expected to attain greater activation.

Within this multiple-documents representation, several factors are hypothesized to play a role in determining the outcome of competing activation. These factors include (1) the number of links or connections between the intertext model and the situations model; (2) the type of connections among documents and concepts; and (3) source credibility (i.e., the perceived willingness of a source to provide accurate, reliable information; Pornpitakpan, 2004) of the information sources within the documents. Next, we propose ways in which each of these factors may influence competing activation in KReC-MD.

Number of Connections The *number* of connections between elements in the intertext model and elements in the situations model is expected to influence knowledge revision outcomes. The number of these connections should roughly correspond to the number of idea units in the documents that support the global correct idea versus the global misconception. Thus, whichever idea is more richly linked to the intertext model would receive increased activation and consequently form a stronger memory representation. This is much like how, in single-document knowledge revision, the rich connections inherent in the explanation provided in a refutation text support activation of the correct idea at the expense of the misconception. With KReC-MD, though, the rich connections supporting the global correct idea result from the revision of individual misconceptions over the course of engaging with multiple documents.

Types of Connections There are several types of connections hypothesized by the DMF. Particularly, documents in the intertext model may be linked to concepts in the situations model via intertext links. Documents may also be linked to other documents within a document set (source-source links). For example, if a document refers (either explicitly or implicitly) to another document, readers may represent a link between those two documents. This is important because these documents may mutually bolster the activation of their respective information. This increased activation, in turn, supports the idea in the situations model to which it is linked—either the global misconception or correct idea.

One important question is whether links between documents in the intertext model can influence revision regardless of whether the two documents conflict with or corroborate each other. This is particularly critical given that readers are likely to encounter documents that conflict with each other when they seek information on the internet related to their misconceptions. In such situations, existing work suggests that readers may shift their attention to the sources of the documents as a means of restoring coherence (Braasch & Bråten, 2017; Perfetti et al., 1999). Moreover, readers may be likely to affirm information from high-credibility sources and/or discount information from the lower-credibility sources (Kobayashi, 2014; Sparks & Rapp, 2011). In other words, information from sources that the reader perceives as highly credible may garner relatively higher activation and may therefore be more readily integrated into readers' documents model than information from low-credibility sources.

Source Credibility Source credibility has been shown to influence the extent to which readers use source information (Pornpitakpan, 2004). Whether readers attend to, encode, and use source information may be a function of task demands. As mentioned, to attend to and use source information, readers typically must be explicitly instructed to do so (Van Boekel et al., 2017) or encounter a discrepancy between texts, within a text, or between texts and prior knowledge (e.g., Braasch et al., 2012).

Within the context of refutation texts, Van Boekel et al. (2017) examined the role of source credibility of the characters that provided refutations and explanations (i.e., embedded sources; Bråten et al., 2018). The results indicated that source credibility influenced knowledge revision such that participants experienced greater interference from their reactivated misconception in the low-credibility condition and demonstrated worse revision after reading. These findings suggest that information from low-credibility sources may attain relatively less activation and may be less readily integrated compared to information from high-credibility sources. Thus, information from low-credibility sources may have a relatively difficult time overcoming the misconception during competing activation. In turn, this would suggest that knowledge revision is more likely to unfold successfully when the global correct idea is supported by information from high-credibility sources.

KReC-MD: Examples and Illustrations

In what follows, we walk through two scenarios of knowledge revision in which a reader engages with a set of three documents that includes refutation texts. These scenarios do not capture all the factors that may influence knowledge revision with multiple documents, and they certainly do not capture all the factors that drive multiple-document comprehension. Instead, we present these scenarios only to illustrate the principles of KReC-MD and how the factors outlined thus far may influence revision. Our intent is to stimulate research to further

substantiate KReC-MD's principles and examine how these factors—and additional factors—influence knowledge revision processes and products in the context of multiple documents.

Within the set documents readers engage with in these two scenarios, each text addresses a specific GMO-related misconception: (1) *Most crops humans consume are GMOs*; (2) *GMOs accumulate in animal products like meat*, *eggs*, *and milk*; and (3) *GMOs are reducing honeybee populations*. The three refutation texts, considered holistically, relate to a more global, higher-order misconception (i.e., *GMOs are harmful*). This global misconception relates to each of the three specific misconceptions targeted in the refutation texts and is therefore expected to be reactivated when a reader engages with the document set.

In one scenario, the documents come from high-credibility sources in the domain of GMOs (e.g., Food & Drug Administration, US Department of Agriculture, Organic Farmers Association). In a second scenario, the documents come from relatively low-credibility sources in the domain of GMOs (e.g., Fox News, Huffington Post, Buzzfeed; Butterfuss, 2020). One assumption we must make for these scenarios is that the reader perceives the credibility of the sources as intended—in other words, we assume that the reader perceives the high- and low-credibility sources as such. Additionally, given that the goal of these scenarios is to illustrate the core KReC-MD processes that occur during reading of multiple refutation texts, we assume that conditions that foster knowledge revision and document engagement have been met. Namely, with respect to revision, we assume ideal text conditions (i.e., refutations and explanations of misconceptions) that foster knowledge revision processes, and with respect to document engagement, we assume that the reader is motivated to engage with the set of documents and that they engage in a reading task that has been shown to facilitate understanding and integration of information in multiple documents (e.g., reading to construct an argumentative essay or research report for policy makers; e.g., List et al., 2019; Wiley & Voss, 1999). Finally, as mentioned, the role of top-down, strategic processes are critical to multiple-document comprehension. However, to illustrate how knowledge revision—which has been conceptualized as a largely bottom-up process (Kendeou & O'Brien, 2014)—operates in multiple-document contexts, we rely on existing models that outline the roles of top-down processes (e.g., RESOLV, Rouet et al., 2017). Consequently, for the purposes of the scenarios, we assume a skilled reader who is motivated to engage with the documents and task.

In the first scenario, the reader *encodes* the refutation and explanation in each refutation text, with each text *passively reactivating* to some extent the global misconception that *GMOs are harmful*. Once this *co-activation* occurs, content from each of the refutation texts becomes *integrated* with the global misconception into a single network. Because each text contains an explicit discrepancy via a refutation, readers may be likely to shift attention to source information, and consequently, source-source and source-content links may also be integrated into this network. Moreover, if a document reactivates information from previous text, there could be links between documents. Thus, the result of these processes is a network of documents (i.e., an intertext model) and newly encoded information from the texts and reactivated memory contents (i.e., a situations model), which are linked to form a documents model (see Fig. 1, left panel, for an illustration). Because each refutation text contributes unique information in support of the global correct idea, there should be a relatively strong link between the intertext model and the global correct idea in the situations model (*that GMOs are safe*). Moreover, the global misconception (*GMOs are harmful*) is related to each specific misconception addressed in the refutation texts. Thus, readers may also integrate a link between the misconception and the intertext model.

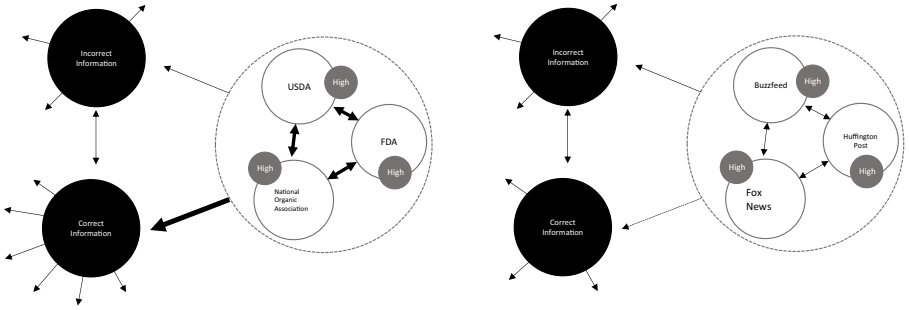

Fig. 1 KReC-MD Documents model in scenario 1: high-credibility sources (Left) and scenario 2: low-credibility source (Right). Black circles represent concepts in the situations model. The large dotted circle represents the intertext model, and smaller white circles represent the documents. Gray circles represent source credibility tags. Double-headed arrows represent source-source links. Single-headed arrows represent intertext links

Because each source is high-credibility in this scenario, information from these sources receives a high-credibility "tag" that may serve to increase its activation (Sparks & Rapp, 2011). By contrast, information from low-credibility sources may garner relatively less activation, as source credibility serves as a cue to either endorse or reject information (e.g., Stadtler & Bromme, 2014). In turn, this increased activation for information from high-credibility sources supports the activation of the idea with which it is linked (e.g., in this case, the global correct idea that *GMOs are safe*).

In this scenario, the outcome of competing activation may be fairly straightforward given the qualities of the documents within the set of refutation texts. Namely, there are three explanations that support the global correct idea that *GMOs are safe*, whereas none of the texts supports the global misconception that *GMOs are harmful*. Thus, there is a stronger connection between the integrated contents of the refutation texts (i.e., intertext model) and the global correct idea in the situations model. Moreover, information from each document is heightened in activation because of high source credibility, and the documents are interrelated via their semantic overlap. Thus, it is clear that the global correct idea should garner a relatively high level of activation at the expense of the activation of the global misconception (as indicated by the relatively bold connection between the intertext model and the "Correct Idea" node in the situations model). Thus, knowledge revision of the global misconception that GMOs are harmful should be facilitated.

In a second scenario, a reader engages with a similar document set, but the three sources are relatively low in credibility. In this case, the same sequence of processes unfolds much like it does in the first scenario—at least until the competing activation mechanism. Namely, the information in the texts is tagged as low-credibility, which introduces a few possibilities: (1) the low-credibility sources garner relatively little activation—compared to instances in which documents are tagged with high-credibility—and thus have attenuated links to the idea they support (Van Boekel et al., 2017); (2) the low-credibility of the sources could lead readers to reject or negate the information from those sources (Stadtler & Bromme, 2014): (3) it is also possible that the reader could reject the information and actually affirm the *opposite*, resulting in increased activation of the misconception (e.g., Sparks & Rapp, 2011). The first possibility may be more likely if the reader does not integrate strong source-source links during reading, whereas the last two possibilities may be more likely if the reader deeply integrates source-source links. Consistent with D-ISC and the CSI model, the strength with which the reader

represents source-source links may depend on awareness of the explicit discrepancy inherent in the refutation (Braasch & Bråten, 2017; Stadtler & Bromme, 2014). In this illustration, we propose the most straightforward possibility—that the reader forms rather weak source-source links and discounts the information from the low-credibility texts. Figure 1 (right panel) illustrates how this reader's documents model may have been constructed during reading of the refutation texts.

In scenario 2, the outcome of competing activation is less straightforward. Although the documents refute and explain specific misconceptions that relate to the global misconception that GMOs are harmful, the low-credibility sources may lead the reader to integrate source-source links rather shallowly and thus discount their respective content (Stadtler & Bromme, 2014). This leaves none of the three sources to substantially impact the activation of the global misconception. In other words, the connection between the intertext model and global correct idea in the situations model is attenuated because the information from those sources was discounted and therefore weakly integrated (represented by the dashed line between the intertext model and the global correct idea node in the situations model).

Given that the links among sources are relatively weak and the correct information from the documents is discounted, little activation would be garnered for the global correct idea. According to competing activation, this means that relatively little activation would be drawn away from the global misconception. Taken together, the result may be that lasting revision of the global misconception is unlikely.

Concluding Remarks and Future Directions

The aim of this paper was two-fold. First, we reviewed the representational and processing aspects of influential accounts of multiple-document comprehension and knowledge revision with a particular emphasis on how readers negotiate conflicting information during reading. This review served as the foundation for our second aim to expand our current account of knowledge revision in order to account for multiple-document contexts. In doing so, we proposed an initial conceptualization of the Knowledge Revision Components Framework–Multiple Documents (KReC-MD). This initial conceptualization of KReC-MD draws directly from existing work and garners predictions for future experimental work to address.

Why is an account of knowledge revision in the context of multiple documents necessary? First, readers are consistently confronted with multiple documents and sources, both in the context of educational tasks and informal reading. This is especially true online, where the amount of information that reactivates and reaffirms consequential misconceptions is an increasing threat to our intellectual survival (Kendeou et al., 2020). Second, there is a theoretical void in the extant text and discourse literature to account for knowledge revision given the additional representational and processing complexities introduced by multiple documents.

Future empirical work could use multiple methodologies to examine how various text-level and reader-level factors could influence knowledge revision with multiple documents and provide empirical basis for refining and specifying KReC-MD, as well as identify conditions that may optimize knowledge revision in these contexts. With respect to text-level factors, future research could explore how different kinds of conflict within a set of refutation texts influence knowledge revision processes and outcomes. For example, a document set could contain texts that are consistent with one another, as was the case in the preceding illustrations.

However, a document set could also include texts that contain conflicting information, rather than corroborate one another. Additionally, the documents within a set could come from sources that vary in credibility, accuracy, and intent, and contexts (i.e., social media, internet search engine results, etc.). Documents may also vary in their semantic overlap or intertextual cohesion, which may influence the extent to which readers integrate information across texts (Kurby et al., 2005). It is currently unknown how such text-level factors could influence knowledge revision with multiple documents.

With respect to reader-level factors, there is existing work that suggests that readers' epistemic beliefs—or beliefs about the nature of knowledge and knowing (e.g., Bråten, 2010)—may influence understanding of multiple documents generally. Specifically, readers who have more adaptive epistemic beliefs and believe that knowledge is complex have been shown to engage more deeply with multiple documents and demonstrate better comprehension (Bråten & Strømsø, 2006; Strømsø et al., 2008). Moreover, readers' executive functions (i.e., processes that modulate cognition, including updating, inhibition, and shifting; Miyake et al., 2000) have been shown to influence comprehension and knowledge revision with single texts (Butterfuss & Kendeou, 2018, 2020; Follmer, 2018), but little is known about how executive functions could influence multiple-document comprehension. Future research must explore the roles of such top-down, reader-driven processes in knowledge revision. For example, future work could examine how strategic factors such as source evaluation, comprehension monitoring, cross-document linking strategies (e.g., Anmarkrud et al., 2014), validation of text contents against prior knowledge (Richter, 2015; Richter & Maier, 2017), or active search for information (e.g., Kurby et al., 2005) influence the outcome of KReC-MD's integration and competing activation principles.

Additionally, future work must adopt a multidimensional conceptualization of prior knowledge. Namely, existing research in knowledge revision has predominantly considered only the *accuracy* of readers' prior knowledge. However, according to the Multidimensional Knowledge in Text Comprehension framework (McCarthy & McNamara, in press), readers' prior knowledge can vary along several additional dimensions, including amount (i.e., how many relevant concepts a reader understands), specificity (i.e., the overlap between knowledge and information in the text), and cohesion (i.e., interconnectedness of prior knowledge). Given that multiple-document contexts may reactivate a greater breadth and depth of both accurate prior knowledge and misconceptions, examining how these factors may influence knowledge revision would provide a deeper understanding of how to target more complex misconceptions.

In conclusion, much work, both theoretical and empirical, is needed to develop a comprehensive, detailed account of knowledge revision during multiple-document comprehension. A more detailed account of knowledge revision with multiple documents could be leveraged to reduce the impact of misconceptions that are reactivated and strengthened by information on social media platforms and other unregulated online environments. Moreover, a better understanding of knowledge revision in complex reading contexts could be applied to educational interventions and instruction. The first steps and initial proposal in this paper may prove useful as the early groundwork necessary for this work to develop.

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Conflict of interest The authors declare no conflict of interest.

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