

Developing a Text-Integration Task for Investigating and Teaching Interdisciplinarity in Science Teams

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Abstract: Integrating information from multiple sources is an important literacy skill that involves: identifying intra and inter-textual ties; modeling relationships between sources and claims; and evaluation of the claims made. Tasks that involve reading, interpreting and synthesizing multiple sources have been explored particularly in the epistemic cognition literature. Interdisciplinarity is a growing area of interest in education, with commensurate interest in the learning sciences regarding the means by which we induct students into interdisciplinary ways of thinking and working. While interdisciplinary contexts frequently involve connecting multiple sources, from different disciplines, these text-integration tasks have not been well investigated.

Introduction: Text integration as a lens on learning

Rouet (2006), suggests key skills important in the context of dealing with multiple sources (particularly rich-multimedia environments): *integration* of prior knowledge and across documents (including competing claims); *sourcing* of features that identify the provenance, genre, etc. of the information; and *corroboration* to check information across multiple sources. A task that probes these processes is text-integration or synthesis writing, in which students construct representations of how multiple sources fit together in relation to a particular task or issue (Goldman, Lawless, & Manning, 2013). As Goldman, Lawless and Manning (2013) highlight, synthesis can occur in a number of different task contexts, including: Integrating differing genres of texts targeted at a shared theme; integrating texts that contain agreements and contradictions on a shared theme; and integrating texts that each contain pieces of information regarding a particular theme, each contributing a part of the picture.

A body of work in this area has explored these abilities to comprehend and integrate information from multiple sources, specifically viewing such behaviours through the lens of epistemic cognition (see Ferguson, 2014, for an overview). In this work, students' cognition around the certainty, simplicity, source, and justification of knowledge is seen as a key mediator for how sources are treated and made use of, assessed through knowledge-tests or constructed responses. Thus, in text integration tasks, the ways in which sources are drawn on may give insight into learning. However, students may not source well, only drawing on limited sources, or failing to integrate them. Recent work on literacy and epistemic cognition (Anmarkrud, Bråten, & Strømsø, 2014; Bråten, Braasch, Strømsø, & Ferguson, 2014) suggests that students tend not to explicitly source, or to use the full list of sources available to them.

Text integration is receiving increased attention in writing research, as a higher-order learning activity in its own right (Klein & Boscolo, 2016). Alongside this attention, there is increasing recognition of the disciplinary nature of writing (Klein & Boscolo, 2016). Despite the dual recognition of text integration tasks as a higher-order learning activity, and of the nature of writing as disciplinary, a feature of text integration tasks that has been little explored is the nature of disciplinary context. In interdisciplinary contexts, text integration is particularly interesting, and under-researched. Much of the, limited, research on learning to do interdisciplinary research focuses on ways of collaborating, sharing and translating knowledge from different disciplines in teams. For example, Pennington et al. (2016) highlights the key stages of (1) identification of an appropriate research question; (2) agreement on a shared vocabulary; (3) the co-creation of boundary negotiating objects; (4) tools for visualizing and combining data, with the aim of (5) producing a new, connected model of understanding. Given that a common output for research teams is in written form, whether an article, policy recommendation, or research proposal, text integration is key to the successful synthesis of disciplinary perspectives and appropriate communication to stakeholders.

In Bråten et al. (2011) the authors describe some key relationships between a model of multiple document comprehension, and epistemic cognition. In that piece, they highlight, for example, that we would expect those people who have less adaptive perspectives on the 'simplicity' of knowledge to engage with multiple documents in a way that emphasizes simple over complex sources, and accumulation of facts over integration. Adapting this work to interdisciplinary contexts, we posit that prior work on epistemic cognition and sourcing in text integration tasks can inform our understanding of interdisciplinary synthesis production. Thus, interdisciplinary learning contexts can draw on text-integration literature to develop tasks to probe key epistemic concerns in interdisciplinary problem solving. These tasks can be developed by providing learners with texts from

multiple disciplines, within a particular context in which they must work towards identifying a specific problem, using a shared vocabulary, and set of resources to develop new understanding towards some ends, such as a policy recommendation or research proposal.

Present study

In the research conducted, 13 graduate students from diverse disciplines completed a text-integration task as part of a wider summer school program on interdisciplinary approaches in the environmental sciences (Thompson et al., 2017). Students were asked to write a synthesis of three articles, on a shared theme (the water-food-energy nexus), but each from a different disciplinary context. The students were asked to draft syntheses on day 3, with opportunities to redraft on days 5 and 8, and a final submission at the end of the event. To analyze the syntheses, we identified features of the text that align with the high-level constructs to develop a rubric based on our prior work investigating a text integration task (Knight, 2016; Knight et al., 2017), intended to be useable by an instructor or student without the need to undertake a laborious coding of individual sentences or idea units within a given text. The rubric builds on prior work focusing on: the specific content that students include in their texts; their use of explicit and implicit citation; the evaluation of the citations and the content drawn on; and the ways in which that information is synthesized (both within individual texts and across multiple sources). The syntheses were thus analyzed with respect to their inclusion of topics or themes from the sources, intra- and inter-textual synthesis, evaluation, and sourcing (which articles were explicitly referred to). Analysis of the texts using this rubric facilitated the generation of specific feedback designed to address the key features of textual synthesis. The development of this task has shown that synthesis writing, and its links to features of epistemic cognition – simplicity, complexity, identifying sources, and justification – provide opportunity for investigating models of interdisciplinary learning and collaboration.

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