



The relationship of (perceived) epistemic cognition to interaction with resources on the internet



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ABSTRACT

Information seeking and processing are key literacy practices. However, they are activities that students, across a range of ages, struggle with. These information seeking processes can be viewed through the lens of epistemic cognition: beliefs regarding the source, justification, complexity, and certainty of knowledge. In the research reported in this article we build on established research in this area, which has typically used self-report psychometric and behavior data, and information seeking tasks involving closed-document sets. We take a novel approach in applying established self-report measures to a large-scale, naturalistic, study environment, pointing to the potential of analysis of dialogue, web-navigation – including sites visited – and other trace data, to support more traditional self-report mechanisms. Our analysis suggests that prior work demonstrating relationships between self-report indicators is not paralleled in investigation of the hypothesized relationships between self-report and trace-indicators. However, there are clear epistemic features of this trace data. The article thus demonstrates the potential of behavioral learning analytic data in understanding how epistemic cognition is brought to bear in rich information seeking and processing tasks.

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1. Introduction

The internet boosts our collective and individual capacity to store and seek information for a variety of purposes. Yet, “searching and processing information is a complex cognitive process” (Walraven, Brand-Gruwel, & Boshuizen, 2008, p. 623), and one that students across a range of ages find challenging (see, for example, Bartlett & Miller, 2011; Hargittai, Fullerton, Menchen-Trevino, & Thomas, 2010; Kammerer, Amann, & Gerjets, 2015; Livingstone, Bober, & Helsper, 2005; Van Strien, Brand-Gruwel, & Boshuizen, 2012; Walraven et al., 2008; Williams & Rowlands, 2007). Consider, for example, situations in which: a parent is attempting to

understand information around childhood vaccinations; a voter wants to investigate the plausibility of a politician's climate change claims; or someone seeking to lose weight wishes to investigate the merits of diet versus regular foodstuffs or supplements. In each case, the information seeker requires more than just the ability to read content; the information seeker must make decisions about where to look for information, which sources to select (and corroborate), and how to synthesize (sometimes competing) claims from across sources. These information skills are key literacy skills for 21st century multimedia environments (OECD, 2013; OECD & Statistics Canada, 2010), indeed “reading literacy is understanding, using, reflecting on and engaging with written texts, in order to achieve one's goals, to develop one's knowledge and potential, and to participate in society.” (OECD, 2013, p. 9).

In this article, we argue that processes of information seeking and processing relate to the epistemic cognitions – beliefs about knowledge and knowing – which are brought to bear on the information found and their relevance to completion of a particular task (Bromme, Pieschl, & Stahl, 2009). Specifically we agree with

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Hoer, that, “exploring students’ thought processes during online searching allows examination of personal epistemology not as a decontextualized set of beliefs, but as an activated, situated aspect of cognition that influences the knowledge construction process” (Hofer, 2004, p. 43). Empirical evidence indicates that, in self-report and talk-aloud data in controlled experimental studies, there is indeed such a connection between epistemic beliefs evidence by psychometric assessment and information seeking. However, more naturalistic large-sample contexts – including the socially situated nature of information seeking – have not typically been studied, nor the digital trace data created in such information seeking. It is the aim of this paper to investigate these issues, to provide analysis of epistemic cognition in the context of a more socially oriented, naturalistic, study environment.

1.1. a. Background

A common class of research across the epistemic cognition literature has focused on its role in multiple document processing (see reviews by, Bråten, 2008; and, Ferguson, 2014). This sort of research is particularly interesting in the context of information seeking, given the need in such activities to deal with multiple websites (documents) and their potentially conflicting, and related, information. A typical pattern in this research involves gathering psychometric data on epistemic cognition, and then asking students to engage in some task – constructing an argument, or summarizing information – using a number of pre-selected documents, selected for their variability in terms of credibility and information.

Some of this research has further utilized think-aloud protocols to gather epistemic data, notably that of Mason, Boldrin and Ariasi (2011; 2010a, 2010b) who find that students do spontaneously reflect on epistemic concerns in information seeking while using a ‘dummy’ search interface (designed to return a pre-selected set of documents). Additional work in online information seeking contexts suggests that students with more “evaluative stances” on psychometric measures are more likely to meaningfully evaluate websites, with integration and critical evaluation of multiple online sources more likely of those with more sophisticated perspectives on the “multiplicity of knowledge” (Barzilai & Zohar, 2009, 2012). Further preliminary work suggests an association between “evaluativist” beliefs and comprehension of multiple conflicting online sources, but not multiple converging perspectives in online sources (Barzilai & Eshet-Alkalai, 2013). However, it should be noted that the use of think-aloud protocols may – as an artefact of the method – increase practices such as credibility judgements (Schraw & Impara, 2000; Schraw, 2000, pp. 297–321).

Navigation of rich multimedia environments introduces additional complexities to information seekers. However, such environments also increase the availability of data to study human interactions with them, in order to understand core literacy concerns such as how people select, evaluate, and integrate claims. A body of work on epistemic cognition has emerged investigating this issue, however, while some work has made use of think-aloud protocols, most research has used controlled document sets, and has not made use of digital trace methods to examine information seeking patterns. Three approaches have emerged in the extant literature thus far, involving investigation of:

1. student's assessments of the trustworthiness of documents known to the researchers
2. self-report psychometric instruments regarding internet specific epistemic cognition
3. student's self-reports of information seeking practices

1.2. Trustworthiness assessments in multiple document processing

Within the document processing literature, one research paradigm has been to ask students to assess the ‘trustworthiness’ of the resources they have encountered. That research has demonstrated that, more advanced students are – when they engage in evaluative behaviors over a set of provided documents – more likely to trust unbiased and less likely to trust biased sources (Anmarkrud, Bråten, & Strømsø, 2014). Furthermore, even while controlling for prior knowledge and text comprehensibility, students who believe in personal interpretation are less likely to trust documents, and those who believe claims should be evaluated are more likely to trust scientific documents than those relying on experience (Strømsø, Bråten, & Britt, 2011); indeed across students there is greater trust in textbooks than news sources, with a focus on content over date of publication in making judgements regarding trustworthiness (Bråten, Strømsø, & Salmerón, 2011).

In the two key studies of Anmarkrud et al. (2014) and Bråten, Braasch, Strømsø, and Ferguson (2014) students were given six texts to read (on the cancer-risks of mobile phones) with conflicting perspectives and varying source-feature trustworthiness, with the framing prompt to:

Imagine that a close friend has told you that she experiences discomfort when using her mobile phone. She has asked you for advice and you have searched the Internet for information about the topic. The search resulted in six results ... (Anmarkrud et al., 2014, p. 5; Bråten et al., 2014, p. 18).

The participants were instructed to read the six ‘search results’ over 40 min, in order to provide their friend with “well-grounded advice”. They were then given an essay prompt, to address in 20 min, without access to the source-documents:

You are now going to write a brief report where you judge the health risk of cell phone use. Base your report on the texts that you just read and try to express yourself clearly and elaborate the information—preferably in your own words. Justify your conclusions by referring to the sources you have been working with (Anmarkrud et al., 2014, p. 4; Bråten et al., 2014, p. 15, p. 15).

This follows earlier research (Anmarkrud et al., 2014; Bråten et al., 2014) in which students were asked to read multiple conflicting documents and, following writing a short report, rank those documents according to their trustworthiness. Following ranking, they were then asked to give reasons for their decision. In that earlier work, students were given only the title and metadata (e.g. author, publisher, date of publication) rather than the complete content of the document. As such, their trust assessments were based off recollection or features foregrounded in the metadata and title, rather than a holistic assessment of the original source. In addition, ranking forces ordinal judgements, and cannot represent interval-level distinctions. As such, a document set of three with two equally ‘low’ and one ‘high’ rated document would be ranked on a 1–3 scale, where – in contrast – a rating scheme (of 1–5) might permit a ranking of ‘1’ ‘1’ and ‘5’. There is thus scope for analysis of ratings of trustworthiness based on holistic features of source documents.

1.3. Internet specific epistemological Beliefs

One psychometric instrument of particular relevance to information seeking and epistemic-commitments is the ISEQ (Bråten, Strømsø, & Samuelstuen, 2005), which has been deployed in several similar tasks to the one described here (Kammerer, Bråten, Gerjets, & Strømsø, 2013; Kammerer et al., 2015; Strømsø & Bråten, 2010). The ISEQ is a 36-item instrument with a 4-factor conceptual

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