Emotional reactivity and comprehension of multiple online texts☆,☆☆

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A R T I C L E   I N F O

A B S T R A C T

This study investigates the role of students' dispositional emotion reactivity in the comprehension of conflicting online information about the topic of health risks associated with the use of mobile phones. Arousal was measured by changes in electrodermal activity as a physiological response to an emotionally negative school-related video. Emotional valence was assessed by self-reports. One hundred and four 7th graders read six texts about the topic in websites varying for reliability and position. After reading, a sentence verification test assessed surface comprehension within texts, while a short essay assessed their comprehension across them at intertextual level, including sourcing and argumentation. Results revealed that two reliably distinct profiles of emotional response, high reactive and low reactive, emerged from a cluster analysis when considering both arousal and valence of emotionality. These profiles differentiated intertextual comprehension at sourcing level, while controlling for possible interfering variables. Low reactive students outperformed high reactive students for the ability to refer to source information and to connect it to the content provided. Findings indicate the importance of student differences in emotional reactivity in a common comprehension task in the digital era.

1. Introduction

What influences the comprehension of information when reading online multiple texts is a topical research issue in the digital era as students search the Web daily to retrieve information for academic assignments. In this regard, the role of person-related factors has been examined in the literature on multiple-text comprehension, in both digital online sources and print. Most attention has been concentrated on cognitive factors, such as prior topic knowledge (Bråten & Strømsø, 2010), argumentative reasoning (Mason, Ariasi, & Boldrin, 2011), epistemic beliefs (Barzilai & Eshet-Alkalai, 2015; Bråten & Strømsø, 2010; Kammerer, Bråten, Gerjets, & Stromso, 2013), and working memory (Banas & Sanchez, 2012).

Recently, motivational factors, such as theories of intelligence (Braasch, Bråten, Strømsø, & Anmarkrud, 2014), individual interest (Bråten, Anmarkrud, Brandmo, & Strømsø, 2014), and reading self-efficacy (Bråten, Ferguson, Anmarkrud, & Strømsø, 2013) have also been examined in relation to multiple-text comprehension.

Although there are still some open issues regarding the role of the examined factors, for example epistemic beliefs (Davis, Huang, & Yi, 2017), there is a considerable gap concerning the role of emotional factors when students read multiple texts to learn more about

unfamiliar topics. This underexplored area needs to receive attention, as there are only two recent investigations that have examined the contributions of self-reported epistemic beliefs and emotions experienced by university students when reading multiple conflicting texts (Muis et al., 2015; Trevors, Muis, Pekrun, Sinatra, & Muijselaar, 2017). To extend current research, in the study reported below we focused on emotional factors from a different point of view, by examining readers' dispositional emotion reactivity. This is defined as an individual difference in the tendency to respond with different intensities to emotional material. As such, this disposition depends, at least partially, on biological factors and shows some stability over time (Eisenberg, Fabes, Guthrie, & Reiser, 2000; Calkins & Dollar, 2014; Gottlieb, 1983).

1.1. Multiple-text comprehension

When looking for online information for school assignments, students must often deal with multiple texts and comprehend the information contained within and across them (Goldman, 2004; Stadtler & Bromme, 2013). Multiple-text comprehension requires more than just constructing the meaning of each single text. The latter implies connecting text information with prior knowledge to form a coherent mental representation at the situation model level, according to

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the well-known construction-integration model of single text comprehension (Kintsch, 1998). Multiple text-comprehension relies on a coherent mental representation based on content integration of various texts about a topic or issue. The 'documents model' (Perfetti, Rouet, & Britt, 1999; Rouet & Britt, 2011) is the theoretical framework of reference. With respect to the Kintsch (1998) model that describes superficial and deep levels of single-text comprehension (surface code, textbase, and situation models), the documents model includes the additional layer of *intertext model*. It refers to the representation of information about the sources, that is, author, type of document, purpose, date of publication, etc. The intertext representation also links sources to content, so that a reader can remember who said what. The source-content link is crucial as it helps to discriminate biased source information from trustworthy information in the evaluating process. The intertext model includes a link for each source-content as well as connections between source-content links. For example, in the case of a set of documents representing multiple perspectives on a debated issue, as in the study reported below, good readers may understand the texts as in agreement or disagreement with a position, in a source-source link. Understanding that contrasting positions are due to opposing goals, for example, is important for a coherent and integrated overall representation of conflicting information (Britt & Rouet, 2012).

In the recent MD-TRACE (Multiple Document Task-based Relevance Assessment and Content Extraction, Rouet & Britt, 2011) framework focusing on the processes underlying multiple-text comprehension, comparing, contrasting, and corroborating across texts are critical processes. Only through these processes, are readers able to identify consistencies and discrepancies among documents in order to build a less fragmentary and more integrated representation of a controversial issue.

In the light of these theoretical accounts, it is clear that readers of multiple documents cannot only process text content but also sources (Stadtler & Bromme, 2013). In this regard, as pointed out by Scharrer and Salmerón (2016), the term 'sourcing' refers to various mental activities focused on source information, such as memorizing, evaluating, and using source information. The link between sourcing and multiple-text comprehension is not only theoretically justified, but is also empirically documented by studies using both print (Anmarkrud, Bråten, & Strømsø, 2014; Bråten, Braasch, Strømsø, & Ferguson, 2015) and online texts (Barzilai & Eshet-Alkalai, 2015; Goldman, Braasch, Wiley, Graesser, & Brodowinska, 2012; Strømsø, Bråten, Britt, & Ferguson, 2013). All studies indicate a positive relation between sourcing and multiple-text comprehension, that is, readers' attention to source information (e.g., authors, credential, type of document, date of publication) is associated with greater text-based learning.

The role of cognitive factors has mostly been examined in the literature on multiple-text comprehension. It has been documented that prior topic knowledge is positively associated with multiple-text comprehension as measured by sentence verification and essay tasks (Bråten & Strømsø, 2010; Bråten et al., 2013). Argumentative reasoning as reflected in the ability to identify fallacies in arguments is also positively associated with comprehension of conflicting documents on the same topic (Mason et al., 2011). The contribution of another individual characteristic, epistemic beliefs, has been widely documented. Beliefs about the nature of knowledge and knowing, either in general (Ferguson & Bråten, 2013) or specifically related to a domain (Barzilai & Eshet-Alkalai, 2015), topic (Bråten & Strømsø, 2010) or the Internet as an informational tool (Kammerer, Amann, & Gerjets, 2015) are important. For example, concerning domain-general epistemic beliefs, students characterized by a relatively high level of knowledge and relatively low level of epistemic beliefs in personal justification of knowledge, but with strong beliefs in justification of knowledge by multiple sources, were those who obtained better multiple-text comprehension (Ferguson & Bråten, 2013). As far as Internet-specific epistemic beliefs are concerned, for example, students with strong beliefs that there is correct knowledge on the Web, among other types of

knowledge, were those who selected more objective search results (Kammerer et al., 2015). Moreover, research has indicated that students with higher working memory gained a better appreciation of the underlying implicit relationships across multiple documents compared with lower-memory students (Banas & Sanchez, 2012).

Recently, motivational factors, such as theories of intelligence (Braasch et al., 2014), individual interest (Bråten, Anmarkrud, et al., 2014), and reading self-efficacy (Bråten et al., 2013) have also been examined in relation to multiple-text comprehension. Research has indicated that incremental theory of cognitive ability as well as higher individual interest and reading motivation act as powerful resources when students construct meaning from various documents on controversial topics.

Scarcely explored in this well-developed field of research is the role of emotional factors when students have to deal with conflicting documents. There are only two investigations on this issue, which focuses on discrete epistemic emotions. These are defined as "emotions that are caused by cognitive qualities of task information and the processing of that information" (Muis et al., 2015, p. 169). In the first study, carried out by Muis et al. (2015), undergraduates in three countries (Canada, United States, and Germany) read conflicting texts on the causes and consequences of climate change. Before reading, they reported their epistemic beliefs, and after reading they reported the epistemic emotions experienced in relation to the information read. In the second study, with only Canadian students, thinking-aloud methodology was used to capture self-regulation processes and emotions as they naturally occurred. Findings revealed that students' epistemic beliefs acted as antecedents of epistemic emotions. For example, beliefs in the complexity of knowledge about climate change associated with lower levels of confusion, anxiety, and boredom. Emotions mediated the relations between epistemic beliefs and learning strategies. These, in turn, predicted learning outcomes, mediating the relationships between emotions and the latter (Muis et al., 2015). In the study by Trevors et al. (2017), epistemic beliefs again predicted the emotions experienced while reading three conflicting texts on the same topic of climate change. Emotions, in turn, predicted learning outcomes in various ways. For example, beliefs in the justification of scientific knowledge by inquiry had both positive and negative indirect relations with learning through different emotional paths.

In a different line of research, another investigation examined the influence of undergraduates' (manipulated) negative affective state (threat) on the generation of Internet search terms and retrieval of information from the single text read (Greving & Sassenberg, 2015). Findings confirmed the counter-regulation principle, that is, attention is automatically allocated to information with a valence opposite to one's current affective state: In a positive state, more attention is automatically allocated to negative information, whereas in a negative state, more attention is automatically allocated to positive information. When the participants appraised their current situation as threatening, they generated more positive search terms – about the topic of living organ donation – than participants who appraised their current situations as neutral. The biased information processing during threat also resulted in the memory retrieval of more positive information about the topic. If, on the one hand, the positive bias serves coping needs, on the other it may negatively affect decision making (Greving & Sassenberg, 2015).

To advance current knowledge on the role of emotional factors in complex learning, we investigated the reader characteristic of dispositional emotion reactivity in multiple-text comprehension, that is, a task that requires not only deep processing of the information provided in a set of texts, but also processing of source information that contributes to the construction of a comprehensive and integrated representation of a question or issue. This demanding task may be impaired or supported by the individual tendency to be highly or less reactive to emotional materials. As a consequence, more or fewer cognitive resources may be available to focus on the task.