Learning and Individual Differences 31 (2014) 11–20

Contents lists available at ScienceDirect

Learning and Individual Differences

journal homepage: www.elsevier.com/locate/lindif

Incremental theories of intelligence predict multiple document comprehension

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ARTICLE INFO

Article history:
Received 12 April 2013
Received in revised form 6 November 2013
Accepted 25 December 2013

Keywords:
Implicit theories of intelligence
Multiple document comprehension
Source evaluation
Intertextual inferences

ABSTRACT

This study examined implicit theories of intelligence as predictors of multiple document comprehension in a sample of 59 Norwegian upper-secondary school students. In four multiple regression analyses with multiple document comprehension indicated by students' inclusion of scientific concepts in their essays, discrimination between more and less useful documents given the reading task, consideration of document trustworthiness as a basis for making those discriminations, and ability to draw inferences across documents as outcome measures, beliefs in intelligence as a malleable, increasable quality emerged as a unique positive predictor after controlling for word recognition, prior knowledge, and working memory. However, beliefs in intelligence as a fixed, unchangeable quantity did not emerge as a unique negative predictor. The findings indicate that the benefits of endorsing an incremental theory of intelligence may be more pronounced than the costs of endorsing an entity theory of intelligence in complex reading task contexts.

1. Introduction

Many reading researchers contend that the 21st century information age has been a kind of "game changer" for comprehension, bringing about not only new affordances but also new concerns (Alexander, 2012; Brand-Gruwel & Stadtler, 2011; Britt & Gabrys, 2002; Leu, Kinzer, Coiro, Castek, & Henry, 2013). On one hand, readers can rapidly, almost instantaneously, access a wide range of up-to-date information, particularly when retrieving documents via Internet search engines. On the other hand, such access requires additional competencies, especially in considering the ease of publishing in the current information age. In this sense, readers should be more vigilant about the nature of documents as socially constructed artifacts (written by a particular author, in support of a particular agenda, for a particular publication venue, at a particular point in time, and so forth) (Britt, Rouet, & Braasch, 2013). In addition, comprehension often requires that readers integrate content information germane to their research question that is distributed across multiple documents (Afflerbach & Cho, 2009; Goldman, Braasch, Wiley, Graesser, & Brodowinska, 2012). Taken together, readers must restrict their processing towards reliable, higher quality information to successfully comprehend. It seems reasonable to assume that, if people do not employ critical reading strategies to differentiate the quality and reliability of the information they read, they may experience an overload of information, or even inappropriately integrate both accurate and inaccurate information (Graesser et al., 2007; Stadtler & Bromme, 2008). Moreover, if readers do not strategically infer relationships between concepts found within various documents, their resultant understandings may involve a less coherent mixture of unconnected facts and concepts (Goldman, 2004).

Research to date has highlighted that a number of cognitive variables may be associated with evaluation and integration processes (Banas & Sanchez, 2012; Bråten, Anmarkrud, Brandmo, & Strømsø, 2014; Bråten, Ferguson, Anmarkrud, & Strømsø, 2013; Bråten, Strømsø, & Salmerón, 2011). However, research on psychosocial factors is surprisingly scant. In the current article, we posited that readers' implicit beliefs about the nature of intelligence – whether they believe that intelligence is a fixed and stable characteristic versus malleable and within their control to flexibly develop – might predict the extent to which they will employ strategies to evaluate source features and integrate content information in a multiple document context independent of several cognitive individual difference factors.

Classic and recent empirical research findings support that source evaluation and content integration are both crucial components of multiple document comprehension (Bråten, Strømsø, & Britt, 2009; Britt, Perfetti, Sandak, & Rouet, 1999; Goldman et al., 2012; Rouet, Britt, Mason, & Perfetti, 1996; Wiley et al., 2009; Wineburg, 1991). Bråten et al. (2009) demonstrated that post-reading trust evaluations on reliable documents and considerations of source features in making these trust decisions independently predicted multiple document comprehension, after controlling for readers' prior topic knowledge. Recent studies using verbal protocols also demonstrate that strategies focused on differentiating more versus less useful documents during reading and using trustworthiness criteria when doing so relate to better post-reading multiple document comprehension. For example, Anmarkrud,

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http://dx.doi.org/10.1016/j.lindif.2013.12.012

Bråten, and Strømsø (in press) demonstrated relationships between evaluations of information sources produced during reading and argumentation sophistication and source usage in post-reading essays. Similarly, Goldman et al. (2012) contrasted the kinds of processing that better and poorer learners displayed during reading. Findings suggested that better learners were more likely to go beyond content analyses to evaluate the trustworthiness of the sources of documents compared with poorer learners. Instead, poorer learners spent more time reading unreliable documents and were more likely to include erroneous concepts in post-reading essays. Thus, there is a growing body of evidence that source evaluation strategies support the construction of accurate understandings from multiple documents.

Integration of higher quality content information both within single documents and across multiple documents also appears to promote successful comprehension. In Bråten and Strømsø (2011), college student readers' identification with cross-text elaboration strategies on a post-reading survey positively predicted their intertextual comprehension, a measure of the inferred connections made across the documents. Wolfe and Goldman (2005) showed strong relationships between adolescents' self-explanation strategies during reading – the inferred connections they made both within and across multiple history texts – and their subsequent reasoning performance about the texts' topic. Using longer, more diverse documents, Goldman et al. (2012) demonstrated that more successful college student learners constructed accurate and coherent representations because they employed self-explanation strategies in response to information germane to understanding the scientific topic. Poorer learners displayed less evidence of self-explanation strategies overall, and appeared to give equal weight to more and less reliable information when they did. Thus, inferring relationships among concepts also appears to support learning from multiple documents.

1.1. Cognitive individual differences that predict multiple document comprehension

Empirical research demonstrates that a number of cognitive variables contribute to the facets of multiple document comprehension outlined above. Research has investigated three cognitive variables in particular – word recognition, prior knowledge, and working memory – either as variables of interest or as control variables. For example, many empirical studies of multiple document comprehension control for prior knowledge when judging whether additional variables explain unique variance in comprehension performance. Even with additional variables included in a model, prior topic knowledge often remains a significant and substantial predictor of multiple document comprehension (Bråten et al., 2009, 2014; Strømsø, Bråten, & Samuelstuen, 2008). Moreover, Bråten et al. (2013) investigated the contribution of individual differences in word recognition skill for multiple document comprehension. As has been shown in prior research focusing on the comprehension of single texts (Andreassen & Bråten, 2010; Cunningham, Stanovich, & Wilson, 1990; Samuelstuen & Bråten, 2005; Stanovich, Cunningham, & Feeman, 1984), word recognition was a unique predictor of multiple document comprehension among lower-secondary school students. Finally, Banas and Sanchez (2012) demonstrated that individual differences in working memory capacity uniquely influenced learning of implicit relationships underlying textual materials distributed across multiple web pages.

Obviously, not all individual reader characteristics of importance are cognitive in nature. Other research has demonstrated that psychosocial factors, such as personality traits or dispositions, can strongly influence individuals' propensities to expend efforts towards achievement and performance in a number of contexts and domains. In the current work, we used the cognitive individual difference factors mentioned above as control variables to rule out plausible alternative explanations that they produced the effects, as opposed to the personality predictor of focal interest in this article: readers' implicit theories of intelligence.

1.2. Implicit theories of intelligence predict performance

Seminal work by Dweck and colleagues (Blackwell, Trzesniewski, & Dweck, 2007; Dweck, 1999; Dweck & Master, 2008; Hong, Chiu, Dweck, Lin, & Wan, 1999) has related learners' implicit beliefs about the nature of intelligence to their approaches and ultimate success in intellectually demanding tasks (e.g., acquiring new knowledge and skills). Some learners hold beliefs that intelligence is a fixed, relatively stable characteristic or quantity that is out of their control. Learners who identify with these beliefs are often described as holding "entity" theories of intelligence. Others believe that intelligence is malleable, a quality that is within their control to flexibly develop and change. Accordingly, learners who identify with these beliefs are often described as holding "incremental" theories of intelligence.

A large body of research has established relationships between students' implicit theories of intelligence and their achievement in various learning contexts (Blackwell et al., 2007; Dupeyrat & Mariné, 2005; Faria & Fontaine, 1997; Greene, Costa, Robertson, Pan, & Deekens, 2010; Henderson & Dweck, 1990; Stipek & Gralinski, 1996). For example, Henderson and Dweck (1990), after controlling for prior achievement, found that adolescents endorsing more of an incremental theory of intelligence earned significantly higher grades in the first year of junior high school than did those endorsing more of an entity theory. Experimental research supports the relationships established through correlational work. That is, interventions focusing on the acquisition of incremental theories significantly increased adolescents' achievement test scores (Good, Aronson, & Inzlicht, 2003) and college students' grades (Aronson, Fried, & Good, 2002) relative to controls.

Several empirical reports indicate that theories of intelligence orient differently towards strategic processes during learning, which contributes to ultimate success (Blackwell et al., 2007; Dupeyrat & Mariné, 2005; Hong et al., 1999; Rhodewalt, 1994; Robins & Pals, 2002). Rhodewalt (1994) demonstrated that individuals holding entity theories were more likely to "self-handicap," withdrawing effort or procrastinating within challenging learning contexts relative to those holding incremental theories. Hong et al. (1999) compared entity and incremental theorists' responses to setbacks during learning. Incremental theorists were more likely to modify their strategies by taking remedial action after having received negative feedback compared to entity theorists. Similarly, Blackwell et al. (2007) demonstrated that junior high school students holding incremental theories were more likely to respond to failures by flexibly seeking out new learning and strategies compared to entity theorists and, as a result, increased their achievement. In the same vein, Robins and Pals (2002) showed that incremental theorists displayed a greater evidence of mastery-oriented strategies including effort escalation. In contrast, entity theorists blamed their failure on low ability, and gave up or perseverated on disadvantageous strategies in challenging learning contexts.

Thus, research suggests that adaptive strategy use in challenging task contexts – something that incremental theorists do more often – supports learning and achievement. Moreover, withdrawing cognitive effort or perseverating on futile strategies in response to difficulties – something that is more common for entity theorists – proves detrimental for learning and achievement. Comprehending multiple documents in the current information age can pose quite a challenge for high school and college students for several reasons (Britt & Aglinskas, 2002; Goldman et al., 2012; Wiley et al., 2009). First, complex conceptual relationships within single texts are often left implicit, requiring that readers strategically elaborate information to establish coherence (Chi, 2000; McNamara, Kintsch, Songer, & Kintsch, 1996). Second, documents are seldom written for the student's exact inquiry purpose. That is, readers must select and re-purpose concepts from single documents and infer connections across multiple documents that are otherwise uncertain. Finally, document authors' motives are not always transparent, with documents often originating from unknown or questionable sources that may vary in expertise on the topic, biases, and so forth.