

Adolescent profiles of knowledge and epistemic beliefs in the context of reading multiple texts

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Abstract: Adopting a person-centered approach, we set out to identify profiles of prior knowledge and epistemic beliefs in Norwegian 10th-graders. We identified two clusters that were labeled *low prior knowledge/moderate personal justification* and *moderate prior knowledge/low personal justification*. Clusters differed significantly regarding multiple-text comprehension, with *low prior knowledge/moderate personal justification* students displaying poorer comprehension of texts on an unsettled scientific issue.

Major issues addressed

It is generally accepted that prior knowledge is a predictor of multiple-text comprehension. Recently, epistemic beliefs have also been shown to play a role, with those investigating relations between epistemic beliefs and multiple-text comprehension typically adopting a variable-centered approach, using multiple regression analysis to control for prior knowledge while examining the unique contribution of distinct beliefs about knowledge and knowing (Bråten et al., 2011). However, the relation between knowledge and epistemic beliefs is complex and the two constructs may interact so that separating them in analyses may yield misleading results (Bromme et al., 2008). At the same time, reliance on aggregate data instead of attending more to individuals may mask patterns existing at a personal level (Alexander et al., 1995). This study set out to identify profiles of prior knowledge and epistemic beliefs in 10th-graders, and to investigate implications for adolescents holding such combinations of knowledge and beliefs on multiple-text reading in the domain of science.

Theoretical framework

Multiple-text comprehension, using diverse sources of information to construct and communicate a meaningful representation of a particular issue, is essential in and out of school. Literacy tasks involving multiple texts may depend on readers' ability to judge the validity of knowledge claims, with the term epistemic cognition being used to describe such judgements (Bråten et al., 2011). Much of the current research on epistemic cognition and text-based learning assumes a linear relationship between advanced epistemic beliefs and multiple-text reading (Bromme et al., 2008), but empirical evidence to support this view is equivocal, and there is no agreement as to what *advanced* beliefs entail. One plausible suggestion is that the relation between epistemic beliefs and knowledge about the matter in question may be non-linear and that complex, context-sensitive interactions may exist (Bromme et al., 2008). We think this suggestion has merit and try to contribute to its investigation in the context of multiple-text reading. Another debated issue in epistemic belief research is the dimensionality of beliefs. We continue a line of research focusing on justification for knowing beliefs (Greene et al., 2008).

Methods

Participants were 64 Norwegian 10th-graders (mean age = 14.9). Before reading, students' knowledge about the issue discussed in the texts was assessed using a 20-item multiple choice test. An 18-item measure of epistemic beliefs was administered, focusing on beliefs about justification of knowledge claims in science. As indicated by previous exploratory and confirmatory factor analyses (Ferguson et al., 2012), this measure captures three dimensions pertaining to ways in which students believe knowledge claims should be validated, specifically, by personal justification (sample item: If I think that something is correct in science, then no one can prove that I am wrong), justification by authority (sample item: If a science teacher says something is correct, then I believe it), and justification by multiple sources (sample item: To be able to trust knowledge claims in science texts, I have to check various knowledge sources). Each item was rated on a scale of one to ten. Students then read five authentic texts containing conflicting information on the health-effects of sun exposure, for the purpose of giving a presentation. One text was a neutral, informative text, whereas two texts presented the view that sunrays protect against cancer and two texts put forward the opposing view that sunrays cause cancer. After reading, participants were administered a test of multiple-text comprehension in the form of short-essay questions, designed to capture the integration of ideas across texts.

Results and implications

Acceptable levels of reliability were achieved for all measures (see Ferguson et al., 2012). Ward's minimum-variance hierarchical clustering technique was used to identify patterns in participants' prior knowledge and

epistemic beliefs. Using a dendrogram, we identified two meaningful clusters, with this solution also verified in a comparable group of 10th graders ($n = 57$). Means and standard deviations for clustering variables and multiple-text comprehension are presented in Table 1. We labeled these clusters *low prior knowledge/moderate personal justification* and *moderate prior knowledge/low personal justification*.

Table 1: Means and standard deviations of scores on measures for the two clusters

	Prior Knowledge (max = 20)		Personal Justification (max = 10)		Justification by Authority (max = 10)		Justification by Multiple Sources (max = 10)		Multiple-text Comprehension (max = 14)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Cluster 1	7.11	1.75	5.36	1.47	6.86	1.66	6.48	1.47	6.46	3.05
Cluster 2	12.28	2.49	3.30	1.58	7.15	1.58	6.01	1.86	8.14	3.15

The students in Cluster 1 ($n = 28$) achieved relatively low prior knowledge scores ($M = 7.11$) and moderate personal justification scores ($M = 5.36$), tending to believe that knowledge claims in science should, to some degree, be assessed by relying on personal opinion. In comparison, students in Cluster 2 ($n = 36$) achieved moderately high prior knowledge scores ($M = 12.28$) and low personal justification scores ($M = 3.30$), shying from the idea that own opinion is an important way to evaluate knowledge claims. A multivariate analysis of variance (MANOVA) with cluster group as the independent variable and knowledge, personal justification, justification by authority, and justification by multiple sources as dependent variables indicated a statistically significant overall difference between clusters, Wilk's $\lambda = .36$, $F(4, 59) = 26.12$, $p = .000$, partial $\eta^2 = .64$, and follow-up analyses of variance (ANOVAs) showed statistically significant univariate effects for knowledge, $F(1, 62) = 87.05$, $p = .000$, partial $\eta^2 = .58$, and personal justification, $F(1, 62) = 28.59$, $p = .000$, partial $\eta^2 = .32$, but not for justification by authority or justification by multiple sources, $F_s(1, 62) < 1.19$, $p > .27$. Regarding multiple text comprehension, a one-way ANOVA with cluster group as the independent and multiple-text comprehension as the dependent variable indicated a statistically significant difference between the two groups, $F(1, 61) = 4.54$, $p = .037$, partial $\eta^2 = .069$, with Cluster 2 outperforming Cluster 1.

This study represents a unique contribution to the field by including students' prior knowledge and different dimensions of epistemic beliefs in a person-centered approach. Findings are consistent with Bromme et al.'s (2008) suggestion that relations between knowledge and epistemic beliefs may be non-linear and interactive. Specifically, the configuration of students' prior knowledge and beliefs about justification of knowledge claims by personal means seems to play a role in their comprehension of a complex scientific issue presented in multiple texts. Possibly, moderate prior knowledge may bulwark students against too much trust in own opinion, making students pay more attention to what authors of texts actually say (Bråten et al., 2008). In contrast, students with little prior knowledge may be more inclined to resort to personal opinion when evaluating knowledge claims, the danger being that subjective interpretations then overshadow perspectives contained in texts. Both groups of students that we identified were similar with respect to beliefs about justification by authority and justification by multiple sources. Apparently relatively high levels of those dimensions could not compensate for the detrimental combination of low prior knowledge/moderate personal justification. Hopefully this study may initiate further research on the multidimensional influence of epistemic beliefs and other variables on performance. A better understanding of subgroups that exist in classrooms may also help teachers target less adaptive patterns of knowledge and epistemic beliefs in their instruction.

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