ELSEVIER

Learning and Instruction 21 (2011) 137–151

Learning and Instruction

www.elsevier.com/locate/learninstruc

Epistemic beliefs in action: Spontaneous reflections about knowledge and knowing during online information searching and their influence on learning

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Received 30 March 2009; revised 30 September 2009; accepted 12 January 2010

Abstract

In the present study it was investigated whether high school students are spontaneously able to reflect epistemologically during online searching for information about a controversial topic. In addition, we examined whether activating epistemic beliefs is related to individual characteristics, such as prior knowledge of the topic and argumentative reasoning skill; also whether learning from the Web is influenced by epistemic beliefs in action and the ability to detect fallacies in arguments. The participants ($N = 64$) were students of Grade 13, who were asked to think aloud during navigation. Qualitative and quantitative analyses were performed. Findings reveal that most participants spontaneously activated beliefs about all four dimensions identified in the literature, that is, about the simplicity/complexity, certainty/uncertainty, justification, and source of knowledge, at different levels of sophistication. Most epistemic reflections were about the source of knowledge. Two patterns of contextualized epistemic beliefs emerged and significantly influenced learning from the Web, which was also affected by participants' ability to identify argumentative fallacies.

Keywords: Epistemological beliefs; Epistemic evaluation; Online information searching; Web-based learning

1. Introduction

Research on epistemic beliefs, namely beliefs about the nature of knowledge and knowing (Hofer & Pintrich, 1997), has flourished after Schommer's (1990) seminal study inspired by Perry's (1970) pioneering work. The impact of this type of beliefs on various facets of learning has been widely documented, such as text comprehension and metacomprehension (Kardash & Scholes, 1996; Ryan, 1984; Schommer, 1990); multiple-document understanding (Bråten, 2008; Bråten & Strømsø, 2006a); conceptual change (Mason, Gava, & Boldrin, 2008; Qian & Alvermann, 1995; Sinatra, Southerland, McConaughy, & Demastes, 2003); argumentation (Mason & Scirica, 2006; Weinstock, Neuman, & Tabak, 2004); self-regulation (Muis, 2007; Stahl, Pieschl, & Bromme, 2006); hypertext navigation (Pieschl, Stahl, & Bromme, 2008), and internet searching strategies (Tu, Shih, & Tsai, 2008).

Despite this flourishing research, that has led to documenting the more or less direct role of epistemic beliefs in learning processes, some conceptual and methodological questions in the field remain open and debatable, as critical reviews have indicated (Greene, Azevedo, & Torney-Purta, 2008; Hofer & Pintrich, 1997). It is not within the aims of this paper to discuss all critical issues in the available literature on epistemic beliefs that need to be investigated further, but rather to introduce a conceptual and methodological issue that is not only relevant to the study reported below, but also to the essential question of the measurement of this kind of beliefs.

Almost all the above-mentioned studies on the relationship between epistemic beliefs and learning are based on a multidimensional conceptual framework of the construct, and all studies measured representations about knowledge and knowing by means of self-reported questionnaires or other paper-and-pencil instruments. In fact, despite initial conceptual divergences about what the construct should include or exclude (Hofer, 2000; Schommer-Aikins, 2002), most research relies theoretically on the notion of epistemic beliefs as

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doi:10.1016/j.learninstruc.2010.01.001

cognitive representations organized around dimensions, which are assumed to be stable and consistent across contexts. Self-reported questionnaires are therefore used to identify these beliefs about knowledge and knowing. The most used, although criticized, instrument is Schommer's (1990) questionnaire which measures domain-general epistemic beliefs. Other self-report inventories have been modelled on it (Schraw, Bendixen, & Dunkle, 2002), or drawn from it (Hofer, 2000), to measure both domain-general and domain-specific epistemic beliefs. A promising addition to existing questionnaires has been recently devised to offer a different type of measure. The Connotative Aspects of Epistemological Beliefs (CAEB, Stahl & Bromme, 2007) is a semantic differential scale which aims to capture the associative and evaluative aspects of epistemic beliefs. These aspects are more personal, emotional, and context-dependent, and are to be distinguished from the explicit-denotative aspects. The CAEB can be applied at both domain- and topic-specific levels, and therefore goes beyond the Likert-type measurement of beliefs about knowledge and knowing toward more contextualized measures.

The use of questionnaires usually reflects the decontextualized nature of most research on epistemic beliefs, and this implies that characteristics of the context (e.g., tasks, contents, materials, resources, etc.) in which epistemic beliefs may be activated are not taken into consideration. However, the recent development of questionnaires that measure epistemic beliefs also at the topic-specific level, is a significant step forward (Stromso, Bråten, & Samuelstuen, 2008).

Scholars who have strongly criticized the context-insensitiveness of questionnaires, posit that epistemic beliefs do not correspond to cognitive structures (either possessed or not possessed by an individual) and cannot be identified at either a domain-general or domain-specific level, but only in a given context (Leach, Millar, Ryder, & Séré, 2000; diSessa, Elby, & Hammer, 2003). Their argument about the nature of epistemic beliefs is that they are not stable but context-sensitive cognitive resources, which can be activated in a given context but not in another, since different resources are triggered by different contexts. Scholars in the field of science education in particular have indicated, for example, that the beliefs ''knowledge is transmitted stuff'', ''knowledge is fabricated stuff'', and ''knowledge is a free creation'' are different epistemic resources that may be activated by the same student in relation to different situational variables in the learning context (Louca, Elby, Hammer, & Kagey, 2004; diSessa et al., 2003). In other words, knowledge can be conceived in several different ways, which reflect different context-dependent resources activated in various situations. Classroom observations of behavioral phenomena that manifest how students interpret instructional practices (e.g., tasks, assessment practices, laboratory activities, etc.) epistemically, as well as individual interviews with questions about the nature of knowledge and knowing in different contexts (diSessa et al., 2003; Hofer, 2004b) have, therefore, been adopted consistently as more appropriate methodological instruments than questionnaires.

To extend current research, in the study presented below epistemic beliefs in action were examined, that is, when they are spontaneously activated in a learning situation. Epistemic beliefs about knowledge and knowing are embedded in a given learning context. Theoretically, the study started from the assumption that beliefs about knowledge and knowing should not be considered in isolation from the contextual variables of the concrete learning scenario in which they are activated. If we assess them only decontextualized, through self-report measures, we may fail to capture these beliefs appropriately. Difficulties in replicating the factor structure underlying Schommer's (1990) Epistemological Questionnaire or other self-report measures may be, at least partly, explained by appealing to the decontextualized questions mentioned in the items, which may lead to different interpretations undermining, thus, instrument validity. The present study should not be considered as a study about the role of context as the influence of different contexts on the activation of epistemic beliefs was not examined, but rather, it was focused on a particular learning situation in which beliefs about knowledge and knowing were embedded.

Theoretically, the present study also endorsed Hofer, 2000; Hofer and Pintrich's (1997) multidimensional framework, which is now widely shared among scholars in this field of research (Buehl, 2008), as the basis for identifying the dimensions of beliefs that an individual may hold about knowledge and knowing. According to the authors, there are four dimensions of epistemic beliefs. Two dimensions are about the nature of knowledge: (a) *simplicity of knowledge*, that is, the degree to which knowledge is conceived as compartmentalized or interrelated; it ranges from knowledge as made up of discrete and simple facts to knowledge as complex and comprising interrelated concepts; (b) *certainty of knowledge*, that is, the degree to which knowledge is conceived as stable or changing; it ranges from absolute to tentative and evolving knowledge. The other two dimensions concern the nature of knowing: (a) *source of knowledge*, that is, the relationship between knower and known; it ranges from the belief that knowledge is transmitted from external authority to the belief that knowledge is constructed by the individual who interacts with the environment; (b) *justification for knowing*, that is, what makes sufficient a knowledge claim; it ranges from the belief in observation or authority as sources of knowing to the belief that knowing involves the use of rules of inquiry and evaluation of expertise.

The need for a more context-sensitive assessment of epistemic beliefs, which are triggered by the learning environment and tasks, led to the use of a more naturalistic methodological tool such as thinking aloud in a situation framed by the execution of a particular task. The task used in the present study reported below is nowadays very common: searching the Web for information on an unfamiliar topic. Effectively accessing, identifying, and using internet-based material is not only a question of formulating efficient search queries and applying appropriate reading strategies. It is also a question of evaluating the authoritativeness of Web sources and the veracity of the information provided, since participants