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Effects of a training intervention to foster precursors of evaluativist epistemological understanding and intellectual values

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ABSTRACT

Kuhn (2001) proposed two crucial prerequisites for the will to engage in argumentative thinking: Evaluativist epistemological understanding that provides the base for regarding argumentative thinking reasonable and intellectual values that reflect the extent to which people regard intellectual engagement as being worthwhile. Against this background, we developed a computer-based training intervention in the domain of ecology to foster precursors of evaluativist epistemological understanding and intellectual values as well as conceptual knowledge about epistemological understanding and intellectual values. We tested the training intervention in a control-group experimental design at two points of time: immediately after the intervention and one week later. Participants were 66 German high school students (35 female; mean age = 18.21). We found positive effects of our training intervention on epistemic orientation, intellectual values, and conceptual knowledge that were (still) observable after one week. Overall, the present computer-based training intervention can be regarded as a promising first step on the way to fostering important prerequisites of the will to engage in argumentative thinking.

1. Introduction

Engaging in argumentative thinking can be helpful to gain a deeper understanding when processing conflicting scientific positions. For example, evaluating the strength of arguments and the quality of evidence on which the conflicting scientific positions are built helps to develop a well-founded answer. In order to actually perform argumentative thinking, the "competence to apply" (Kuhn, 2001) argumentative strategies such as evaluating arguments, backing theories with evidence, or rebutting counterarguments is necessary but not sufficient. To engage in argumentative thinking, the "disposition to apply" (Kuhn, 2001) these strategies—in short, the "will" (McCombs & Marzano, 1990)—is also crucial. Kuhn (2001) proposes two prerequisites for the will to engage in argumentative thinking: evaluativist epistemological understanding and intellectual values. Our goal was to develop and test a short-term computer-based training intervention to foster precursors of evaluativist epistemological understanding (i.e., epistemic orientation and the application of evaluativist knowledge) and intellectual values as well as conceptual knowledge about epistemological understanding and intellectual values.

1.1. Epistemological understanding and intellectual values—the developmental approach by Kuhn and colleagues

Epistemological understanding refers to personal epistemology (Barzilai & Zohar, 2014) and describes an individual's thinking about the nature of knowledge and knowing (Hofer & Pintrich, 1997). Thinking about knowledge and knowing can be studied against the background of different and even partly contradicting scientific approaches, for example, the resource approach (e.g., Louca, Elby, Hammer, & Kagey, 2004) or dimensional models (Ferguson & Braten, 2013; Hofer & Pintrich, 1997). In this paper we

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use the developmental approach of Kuhn and colleagues (Kuhn, 2005; Kuhn, Cheney, & Weinstock, 2000; Kuhn & Park, 2005) as theoretical background.

According to Kuhn (2001) there are two prerequisites for the will to engage in argumentative thinking: Evaluativist epistemological understanding and intellectual values. The development of evaluativist epistemological understanding can be seen as the task of coordinating "the subjective and objective dimensions of knowing" (Kuhn et al., 2000, p. 310). Kuhn and Park (2005) proposed three levels of epistemological understanding for individuals between school age and adulthood: At the *absolutist* level of epistemological understanding assertions are seen as either correct or incorrect facts and they should represent reality. Due to the proposed certainty of knowledge coming from external sources, argumentative thinking is regarded as unnecessary—except for determining truth or falsehood. Furthermore, Tsai, Jessie Ho, Liang, and Lin (2011) found that absolutist epistemological understanding led to lower-level conceptions of learning science such as memorizing.

At the *multiplist* level of epistemological understanding, the focus shifts from objectivity to subjectivity: This is usually due to realization that even experts can disagree. Hence, the recognition of the uncertainty of knowledge tempts adolescents in particular to view assertions as freely chosen opinions. Individuals at this level of epistemological understanding do not believe in the discriminability of conflicting assertions and regard argumentative thinking as irrelevant. This intellectually undemanding arbitrariness is equated with tolerance, claiming that all opinions are equally right (Kuhn & Park, 2005).

At the *evaluativist* level of understanding—which not all adults reach, though—arbitrariness is replaced by judgments, regarding some opinions indeed more justified than others based on the evaluation of arguments and evidence. This level of epistemological understanding ultimately provides the rational basis on which one sees argumentative thinking as a reasonable means to enhance understanding and reach to sound conclusions. For instance, Mason and Boscolo (2004) and Mason and Scirica (2006) found in their studies with 8th-grade students that learners with evaluativist epistemological understanding produce arguments of higher quality. In short, in order to engage in argumentative thinking, it is pivotal to regard scientific positions neither as absolute facts nor arbitrary opinions, but as judgments based on evaluation.

However, considering argumentative thinking as reasonable may not be enough to engage in such intellectual engagement if it is not regarded as being intrinsically worthwhile. Therefore, Kuhn and colleagues (e.g., Kuhn & Park, 2005) claim that, in addition to an evaluativist epistemological understanding, there is a second prerequisite for the will to engage in argumentative thinking: intellectual values. Kuhn and Park (2005) described intellectual values as representing the "perceived value of intellectual activity to a cultural group" (Kuhn & Park, 2005, p. 115). As the lower levels of epistemological understanding (i.e., absolutist and multiplist level) "do not provide the rational base needed for sustained intellectual engagement" (Kuhn & Park, 2005, p. 115), intellectual values are considered to be founded on an evaluativist level of epistemological understanding. As evaluativist epistemological understanding and intellectual values develop (if at all) over many years between childhood and adulthood, these constructs might be considered as relatively stable. This stability poses an instructional challenge for developing effective training intervention.

Building on the developmental model by Kuhn and colleagues (Kuhn, 2005; Kuhn et al., 2000; Kuhn & Park, 2005), we address two important precursors of evaluativist epistemological understanding in the sense of Kuhn and colleagues. First, we propose a precursor that refers to *epistemic orientation*. This epistemic orientation represents a tendency to move away from rather absolutist beliefs (e.g., scientific statements are either clearly true or false) toward beliefs that could be more multiplist or evaluativist beliefs (e.g., even if opposing, scientific positions can have some rightness). As evaluativist epistemological understanding develop over many years (if at all), we propose a tendency to move away from rather absolutist beliefs as a first step and precursor for evaluativist epistemological understanding. In line with this proposition, Kuhn et al. (2000) assume that "becoming aware of the uncertain, subjective nature of knowing" (p. 310)—which means nothing less than moving away from absolutist beliefs— as a "key event" of an individual's epistemological development. Furthermore, Hofer (2004) hints that "disequilibration" (p.132)—which can be seen as the imbalance that comes with moving away from absolutist beliefs—paves the way for reaching the next epistemological level.

Second, the *application of evaluativist knowledge* refers to whether an individual, when confronted with two conflicting positions, would actually apply the evaluativist knowledge that there is more than one position and one could be better or more right than the other (Kuhn, 2005). This application of evaluativist knowledge might also be seen as a resource for further epistemological development (cf. Hammer & Elby, 2000). Whereas such an application would not necessarily imply that an individual has reached the evaluativist level of epistemological understanding, it at least shows the acquisition of knowledge that there is more than one position and one of these could be better or more right than the other. Such knowledge represents a key element for the development of evaluativist epistemological understanding (Kuhn et al., 2000). Thus, we consider it to be a precursor of evaluativist epistemological understanding.

1.2. Previous interventions to foster evaluativist epistemological understanding and intellectual values

Methods to foster prerequisites for the will to engage in argumentative thinking are quite rare. Most of them follow the principles of indirect instruction (e.g., Valanides & Angeli, 2005). Kuhn (2005) and Kuhn and Udell (2003) focused on practice methods that had students engage in interactive discourses. In these discourses the students had to recognize different conflicting positions that can vary in the strength of arguments they are built on, thereby developing an evaluativist epistemological understanding. Referring to intellectual values, Kuhn (2005) proposes that adults serving as "role models" interact with adolescents and thereby contribute to the adolescences' valuation of intellectual engagement. Furthermore, according to Kuhn and Park (2005), intellectual values are founded on the evaluativist level of epistemological understanding because the evaluativist level is considered to be the rational base for intellectual engagement. Therefore, fostering the evaluativist level can be seen as a preparation for shaping intellectual values. In order to be effective, however, these methods require a lot of time. For instance, the intervention by Kuhn and Udell (2003) consisted of 16 sessions of 90 min, over a span of 8 weeks. Hence, developing short-term methods would be very useful.

One of two rather new and promising methods to foster "sophisticated epistemological beliefs" (Porsch & Bromme, 2011, p. 807) is the so-called *epistemological sensitization* method (Pieschl, Bromme, Porsch, & Stahl, 2008; Porsch & Bromme, 2011). The authors complemented a text on DNA profiling (genetic fingerprinting) with comments about the epistemological status of the presented facts, pointing out, for example, scientific controversies and/or uncertainties. At least for a short time—which was the goal—this method fostered "sophisticated epistemological beliefs"