

# Exposing and Assessing Learners' Epistemic Thinking

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**Abstract:** The conceptualization of students' personal epistemologies has been criticized for being inconsistently defined, overly simplistic, and inappropriately decontextualized. Broadly, epistemic cognition encompasses explicit thoughts about the nature of knowledge as well as reasoning processes related to knowledge claims and justifications. Learning scientists are invested in understanding epistemic cognition in a variety of authentic settings, but it is challenging to analyze data in meaningful epistemic categories. Participants in this workshop will briefly discuss varied conceptualizations of epistemic cognition and will focus on how to apply these conceptualizations to empirical research. We will explore empirical methods that extend beyond traditional interview and questionnaire methods to better expose authentic, ongoing epistemic thinking. Presentations and discussions will explore means of revealing epistemic thinking in classrooms and other settings and methods of analyzing data from learners' interactions and discourse. A primary goal of the workshop is to foster collaborative, interdisciplinary future work.

## Theoretical Framework

Epistemic cognition broadly refers to an array of understanding, practices, and motivations related to topics such as what counts as knowledge and how knowledge claims are justified. Included in this array are the practices and processes for achieving knowledge. As such, epistemic cognition encompasses both explicit beliefs as well as situated reasoning practices. Recent work by learning scientists, as well as others, has challenged overly simplistic conceptualizations of epistemic cognition (c.f., Chinn, Buckland, & Samarapungavan, 2011). These challenges have emphasized the situated nature of epistemic cognition and have severely criticized some of the most common methods of measuring epistemic cognition, such as questionnaires. At the same time, recent work has stressed and begun to reveal evidence for the role of epistemic cognition in reasoning skills important for learning, education, and civic responsibility (e.g., Bagley & Shaffer, 2009; Schommer-Aikins & Easter, 2006).

A primary challenge for researchers investigating epistemic cognition is that its definitions and the specification of its key components vary widely. On one hand, this means that although emerging trends may be similar across studies, variations in how epistemic cognition is conceptualized create an obstacle for integrative reviews of the relevant literatures (Maggioni & Parkinson, 2008). Differences in terminology and operational definitions result both in a rich array of ideas for analyzing epistemic cognition and in difficulties making sense of how the diverse approaches tie together. A central goal of this workshop is not only to share ideas about how to conceptualize epistemic cognition but to share and discuss how these conceptualizations play out in the analysis of data. We frame the workshop in terms of epistemic cognition, emphasizing students' explicit thoughts and beliefs as well as their reasoning processes and motivations relevant to the nature of knowledge and knowing.

Most research on students' personal epistemologies has relied on quantitative data from questionnaires and surveys. This methodological approach is most likely responsible for the widespread characterization of individuals' epistemologies in terms of a naive/sophisticated dichotomy across prescribed, domain-general dimensions such as certainty, structure, and source of knowledge (Greene, Azevedo, & Torney-Purta, 2008; Maggioni & Parkinson, 2008; Mason, Ariasi, & Boldrin, 2011). One approach to correcting simplistic conceptualizations has extended research beyond domain-general individual beliefs about the nature of knowledge to include survey measures that consider domain-specific individual epistemologies (see Stahl & Bromme, 2007; Maggioni, VanSledright, & Alexander, 2009), epistemic practices (see Hennessey, Murphy, & Kulikowich, 2013) and motivations (see DeBacker & Crowson, 2008). However, more qualitative approaches, including student interviews and think alouds, have revealed that epistemic cognition is more complex, nuanced, and context-dependent than questionnaire-based research has indicated (see Alexander, Winters, Loughlin, & Grossnickle, 2012; Ferguson, Bråten, & Strømsø, 2012; Gottlieb, 2007; Gottlieb & Wineburg, 2012). Research situated in inquiry environments has shown further that students' specific epistemic practices and their ideas about these specific epistemic practices are much more sophisticated than what has been revealed by questionnaire-based research and even interview research (Herrenkohl & Cornelius, 2013; Pluta, Chinn, & Duncan, 2011). It is evident that epistemic cognition is not only situated within a particular domain, or discipline. Instead, recent studies suggest it is situated within task and context as well. For example, in a review

of studies of teachers' epistemologies, Maggioni and Parkinson (2008) found contextual constraints with regard to curricular and institutional factors, including student contribution to classroom discourse.

## Rationale

Research aimed at learners' knowledge acquisition and reasoning must investigate cognitive, metacognitive, *and* epistemic processes. Extensive research in the scientific reasoning literature has examined cognitive mechanisms related to skills such as hypothesis generation and experimental design in science and source evaluation in history (for review see Zimmerman, 2007; Wineburg, 1991). Metacognitive processes such as hypothesis revision, explanation, and argumentation also have been studied extensively with regard to student learning, particularly in science and math domains (Kuhn, 2005). Coherent, interdisciplinary study of epistemic cognition, however, is only beginning to emerge. As mentioned above, traditional approaches for studying student epistemology have relied on interviews and questionnaires, which have been severely criticized as inadequate methods. More recent emphasis on learners' epistemic cognition and related practices calls for investigating situated facets of epistemic cognition and its progression in authentic settings, such as ongoing inquiry environments. We aim, with this workshop, to bring consideration of means of exposing and analyzing learners' epistemic thinking in such environments to the forefront of this area of inquiry. We expect this framing to be particularly relevant for considering the relation among facets of epistemic thought *and* between epistemic processes and meaningful, effective instruction.

The study of learners' epistemic cognition is challenging and the problems of measuring epistemic cognition in its many facets continue to vex the field. Specific challenges create a need for better ways of modeling practical modes of epistemic cognition (Greene, Torney-Purta, & Azevedo, 2010). For instance, we need better ways of analyzing practices (such as practices exhibited in oral discourse) in terms of epistemic categories (Chinn, Buckland, & Samarapungavan, 2011). It is also the case that developmental trajectories of epistemic cognition are unclear in the current literature base. This calls for better ways of modeling students' epistemic cognition progressions within and outside of instructional contexts. To address the challenges raised here, we see as a vital first step the convening of researchers engaged in work that involves novel approaches to exposing epistemic thinking beyond traditional questionnaire and interview methods.

Beyond novel approaches to *exposing* epistemic cognition, challenges must be addressed through relevant assessment and analysis. The *Exposing and Assessing Learners' Epistemic Thinking* workshop allows for sharing recent and ongoing attempts at uncovering learners' epistemic and related thinking processes and for discussing next steps in data analysis and future study design. Exploring means of assessing students' thinking is timely as practitioners and researchers consider how to align assessment with the newly released Common Core and Next Generation Science Standards (NGSS). NGSS, in particular, emphasize the integration of student knowledge and practices requiring not only summative, but formative assessment aimed at revealing *how* students are thinking (National Research Council, 2013). As such, the National Research Council (2013) has called directly for new modes of assessing student thinking and assessing the development of students' understanding of knowledge and associated practices. We expect a discussion of means for assessing learners' epistemic thinking to be highly relevant to this call.

## Goals

In order to address the challenges outlined here, the first goal of the workshop is to promote dialogue surrounding design research of epistemic cognition's nature and development. This goal counters the current trend for segmented, disciplinary study of student epistemologies by targeting an interdisciplinary focus on design research. This goal also emphasizes the situated nature of epistemic cognition, especially in authentic settings. We expect such focus is best for advancing our understanding and modeling of epistemic cognition beyond prior discrepant conceptualizations. The second goal of the workshop is to explore workshop participants' conceptualizations of the *measurement* of epistemic cognition. Within this goal, strong emphasis will be placed on the practical dimensions of epistemic cognition in authentic settings such as the classroom. Importantly, emphasis will not necessarily be limited to dimensions of epistemic cognition that students are able to access and reveal metacognitively. Third, we aim for the workshop to foster discussion of means of analyzing, interpreting, and expanding on existing data. The fourth and final goal of the workshop is to provide opportunities to develop collaborative work across disciplinary lines. Epistemic cognition has been studied through various theoretical lenses – each of which provides a different perspective on the construct. Overall, we aim to converge these perspectives with a specific focus on research design and data analysis in this area. Discussion will aim at fostering collaborative products such as a special topics issue, for example on proposals for exposing epistemic thinking and analyzing data, review papers, or future studies.

## Connections to the Conference Theme

The ICLS 2014 theme of “Learning and Becoming in Practice” highlights the need to develop an understanding of real learning and thinking practices. This workshop seeks to move the study of epistemic cognition from largely decontextualized questionnaires and interviews to settings of rich, authentic inquiry practices. Following long standing philosophical and theoretical consideration of epistemic cognition, it is important to begin exploring possibilities regarding the practical applications of this research -- that is, to determine viable approaches for assessing epistemic cognition, its progression within the individual, its impact on learning, and the role of authentic instructional interventions in promoting its development. By encouraging interdisciplinary participation, we echo the ICLS theme’s recognition that the community of scholars represents a myriad of stances, all with valuable potential to contribute to the advancement of this line of research.

## Workshop Agenda: Expected Contributions and Outcomes

Workshop participants will be invited to submit abstracts in order to present their work. Abstracts submitted for workshop acceptance will be required to include recent or ongoing considerations of epistemic cognition or related reasoning processes. Relevant related reasoning processes may include those such as evidence or source evaluation, argumentation skills, or the psychology of understanding. Emphasis will be placed on research that involves design-based methods of revealing epistemic thinking in the practice of inquiry. In the event more abstracts are received than can be accommodated, preference will be given to presentations of collected data. We expect this will best facilitate discussions of practical methods of data analysis as well as methods for eliciting students’ epistemic cognition. Accepted abstracts and examples of measures, tasks, transcripts, and coding schemes will be posted by facilitators on a wiki page prior to the workshop. The proposed full day workshop will include a fire hose presentation session, whole group discussion, and discussions in smaller “breakout” groups that focus on specific topic strands.

Fire hose presentations will provide the opportunity for participants to present their perspectives with regard to methodology for exposing epistemic thinking. Each presenter will take three minutes to describe his or her current conceptualization of epistemic cognition framed around recent or ongoing methods of assessment and analysis. Fire hose presentations will promote the cross-disciplinary work espoused by our workshop. Following fire hose presentations, workshop facilitators will moderate a whole group discussion structured according to our primary goals. Having whole group discussion immediately after fire hose presentations will give participants an opportunity to respond to peers’ work, as well as to engage in further discourse about the challenges that may arise as epistemic cognition is considered. The discussions will focus on (1) how to conceptualize epistemic cognition, (2) how to expose and capture epistemic cognition in interactive environments, (3) how to analyze data in terms of epistemic categories, and (4) important but neglected areas of research. Ideas generated during discussion will be captured on large sticky notes for later compilation and distribution to small groups. A main goal of this task is to develop a broad range of ideas that merit further exploration and to organize these ideas around challenges specifically related to the workshop and broader ICLS conference theme. Whole group discussion will generate questions and issues to be discussed further in specific topic strand discussions.

Small group discussions will follow whole group discussion. Although facilitators may have ideas for specific topic strands after reviewing the research proposals submitted by workshop applicants, topics will largely emerge in whole group discussion. As an example, a topic strand might address coding schemes for analyzing revealed student thinking. We aim to recruit interdisciplinary researchers and will also encourage topic strands that are representative of these varied perspectives. We aim to have 4-6 distinct topic strands. Small groups will be charged with deciding on an appropriate resulting product (e.g., special topics issue, or review paper) and devising a plan for completing the product. Following the breakout discussions, each group will be given an opportunity to present an overview of their discussions and conclusions. We will close with questions and comments following small group presentations and remarks.

## Workshop Organizers

**Maggie Renken** is Assistant Professor in the College of Education at Georgia State University. Her research explores how science knowledge is acquired, considering the role and development of mechanisms like epistemic cognition. Her study of hands-on experimentation and computer-simulated experiences in students’ physics knowledge is published in *Learning and Instruction*. Work developing a measure of psychology-specific epistemological beliefs is in press in *Teaching of Psychology*.

**Clark Chinn** is Professor in the Graduate School of Education at Rutgers University. His research focuses on epistemic cognition, argumentation, and promoting growth in reasoning through model-based inquiry. Drawing on philosophical work, he and his colleagues recently argued for a substantive reconceptualization of epistemic

cognition in a 2011 paper in *Educational Psychologist*. He is currently working on developing epistemic coding schemes to understand students' interactions in inquiry classrooms.

**Penelope Vargas** is Assistant Professor in the Eugene T. Moore School of Education at Clemson University. Her research focuses on the relationships between epistemic beliefs and motivations, and justification processes in different domains. Her work on epistemic cognition and making sense of evidence in history will appear in the *Journal of Social Studies Research* in 2014. She is currently working on investigating the connections between epistemic cognition and researcher identity in engineering and science students.

**William Sandoval** is Associate Professor in the Graduate School of Education & Information Studies at UCLA. He is interested in the development of epistemic cognition especially in relation to people's understanding and engagement with science. He has written on the topic in *Science Education* and *Journal of the Learning Sciences*, and the 2012 ICLS proceedings, and is currently co-editing the first ever Handbook on Epistemic Cognition to be published by *Routledge*.

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