Scientists Know, Historians Guess:

*What Adolescents Believe About Knowledge and Knowing Across Domains*

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Background on Epistemology: Domain-specific or Domain-general?

- **Personal epistemology:** the study of individual conceptions of knowledge and knowing

- **Domain generality:** beliefs about knowledge and knowing generalize across domains
  - Presumed in early research (King and Kitchener, 1994; Perry, 1970; Schommer, 1990)

- **Domain specificity:** beliefs about knowledge and knowing differ by domain (e.g. history, math, science)
Dimensions of Personal Epistemology

- Review of the literature suggests **four dimensions** (Hofer & Pintrich, 1997), with some empirical support (Hofer, 2000, 2004, 2010):
  
  - **Nature of Knowledge:**
    1. **Certainty of knowledge** (fixed → fluid, tentative, evolving)
    2. **Simplicity of knowledge** (discrete facts → relative, contextual, interrelated concepts)

  - **Nature of Knowing:**
    3. **Source of knowledge** (outside the self → actively constructed in interaction with environment and others)
    4. **Justification for knowing** (through observation, authority, or what feels right → evidence, evaluated expertise)
Current Research

Need for Research:

- Most epistemology research has been conducted with college students; but this is changing (see Bendixen & Haerle, 2010)
- Limited research on epistemological development in adolescence
- Little research that integrates epistemological development, dimensionality, and domain specificity

Current Research Overview:

- 4 year multi-method, multi-measure study, funded by NSF
  - Participants were assessed individually in the lab, and later completed online surveys. Each participant was assessed a second time, one year later, creating both a cross-sectional and longitudinal design
  - Goal is to chart the trajectory in adolescence and create a more nuanced understanding of epistemological development
Research Questions

- How do adolescents perceive the domains of history and science from an epistemological perspective?
- What is the relation between domain-general and domain-specific beliefs?
- Are there differences in beliefs about the two fields in regard to relative certainty, the nature of expertise, the source of knowledge, and the role of justification and evidence?
Method

Participants (in the data set for these analyses):

- Students from central Vermont public schools, randomly selected from class lists provided by principals
- 111 participants, 56% male, 6th (n=26), 8th (n=33), 10th (n=27), 12th (n=26) grades; 10th grade omitted in analyses, thus n=85
- Students compensated for participating and for transportation
Measures

- Epistemic metacognition and online learning: think-aloud protocol (Ericsson & Simon, 1993)
  - Simulated science assignment, search task
  - Retrospective interview - Includes reflections on the task, and additional questions re Wikipedia

- Epistemological interview – adaptation of existing developmental questions plus those written for the study
  - Sample question:
    “What if you had two accounts of the causes of a war, one by a person who lived at that time, and another by a historian, or history expert, who didn’t live through the war, but who has researched it a lot. Which one would you find more believable?” (with follow-up questions)

- Survey
  - Domain general epistemic beliefs about certainty
    - “Truth is unchanging”; “All questions have one right answer”
  - Domain specific epistemic beliefs about certainty
    - “Truth is unchanging in history”; “All questions in science have one right answer”
Results: Justification and Source of Knowing

“What if you had two accounts of the causes of a war, one by a person who lived at that time, and another by a historian, a history expert, who didn’t live through the war, but who has researched it a lot. Which one would you find more believable?”

77% of 6th graders, 73% of 8th graders, and 36% of 12th graders chose contemporary

Most Common Rationale for Choosing Contemporary:

Because Witness Personally Experienced It: Because Historian’s Information Could Be Wrong:

<table>
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<th>Grade</th>
<th>Rationale</th>
<th>Percentage</th>
<th>Sample Size</th>
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<tbody>
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<td>Because Witness Personally Experienced It</td>
<td>100%</td>
<td>20</td>
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<tr>
<td>8th</td>
<td>Because Witness Personally Experienced It</td>
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<td>12th</td>
<td>Because Witness Personally Experienced It</td>
<td>78%</td>
<td>9</td>
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<tr>
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<td>Because Historian’s Information Could Be Wrong</td>
<td>40%</td>
<td>8</td>
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<td>21%</td>
<td>5</td>
</tr>
<tr>
<td>12th</td>
<td>Because Historian’s Information Could Be Wrong</td>
<td>11%</td>
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Sample quotes:

“Definitely the person who was there. Because they saw everything that happened and they know firsthand.” (12th grader)

“A historian might read false information and think that’s the way the war started.” (6th grader)
Certainty of Knowledge: History and Science

"If you were to compare science and history, do you think that knowledge in one subject is more certain than in the other?"

- Students were more likely to view scientific knowledge as more certain than historical knowledge (35% of 6th graders, 36% of 8th graders, and 58% of 12th graders)
  - Few students saw history as more certain than science (0%, 12%, and 4%)

- Rationale for choosing science as more certain than history:
  - Scientists perform experiments (of those students who chose science, 66% of 6th graders, 75% of 8th graders, and 60% of 12th graders)
  - Scientists witness their results (22%, 0%, 20%)
  - Sample Quote: “I think science may be a little more certain because they can experiment (and) can figure it out for themselves” (6th grader)

- Historical knowledge is less certain because:
  - Historians perform guesswork and interpretation (44%, 33%, 33%)
  - Historians could be missing information (0%, 42%, 13%)
  - Sample Quote: “Historians can only guess from things that they’ve found.” (6th grader)
Students typically consider personal experience a chief means of justification of knowledge, whether observing historical events as they occur or witnessing the results of an experiment.

Students prefer witness’s knowledge over historian’s knowledge, frequently citing witnesses as more knowledgeable, factual, and well-informed sources of knowledge than historical researchers:

- Sample Quote: “Definitely the person who was there. Because they saw everything that happened and they know first hand.” (12th grader)

Basis for choosing scientific knowledge as more certain than historical knowledge suggests low understanding of historical research methods. Students apparently mistrust historians’ research and doubt the validity of their methods and sources.

- Sample Quote: “I mean, the historian probably did a lot of research, but...some of that information could have been wrong.” (12th grader)
Implications for Education

• Importance of firsthand experience suggests primitive understanding of primary vs. secondary sources.
  • *What is needed:* Evaluation of sources of knowledge, particularly in regards to the respective *value* and *limits* of primary and secondary sources.

• Students seem to view acquisition of historical knowledge as a more passive means of learning than that of science, given the lack of firsthand experience with the subject material.
  • *What is needed:* More explicit attention in classrooms to the epistemological basis of history by means of an *ACTIVE* style of teaching history (i.e. students working and thinking like historians), in order to familiarize students with:
    • The *process* of historical research
    • The *validity* of historical knowledge claims