Promoting Knowledge Uncertainty: An Educational Intervention Through Philosophical Inquiry

Marcus Anderson, BMus, GradDipEd, BPsychSc.

Promoting Knowledge Uncertainty: An Educational Intervention Through Philosophical Inquiry

Executive Summary:

This study explores the influence of epistemological beliefs—the individual perceptions of knowledge on learning and cognitive development—on academic achievement and proposes a novel educational intervention to foster knowledge uncertainty through philosophical inquiry. Recognising the gap in current educational practices, which often overlook the impact of deep epistemological questioning on cognitive flexibility and academic success, we developed a hierarchical model to analyse the depth of epistemological beliefs and their relationship with learning outcomes. This model facilitates a nuanced understanding of how beliefs about knowledge certainty and structure can hinder or enhance learning processes.

To address this gap, we introduce an innovative, web-based tool to encourage philosophical inquiry among students, thus challenging their foundational epistemological assumptions. The tool, yet to be empirically tested, offers a series of thought-provoking questions and scenarios that guide users through a self-reflective examination of their beliefs about knowledge, truth, and learning. By integrating philosophical discourse into the educational experience, the intervention promotes a more integrated and sophisticated epistemological framework among learners, potentially leading to improved academic outcomes.

This paper does not present empirical results from using the tool but draws upon existing literature to hypothesise its potential impact. It outlines the theoretical underpinnings of our approach, detailing the anticipated benefits of fostering epistemological uncertainty and the role of philosophical inquiry in education. We invite educators and researchers to engage with the tool, implement it in diverse learning environments, and contribute to a growing body of evidence on its effectiveness. Through collaborative exploration and feedback, we aim to refine the intervention and further our understanding of the complex relationship between epistemological beliefs and learning.

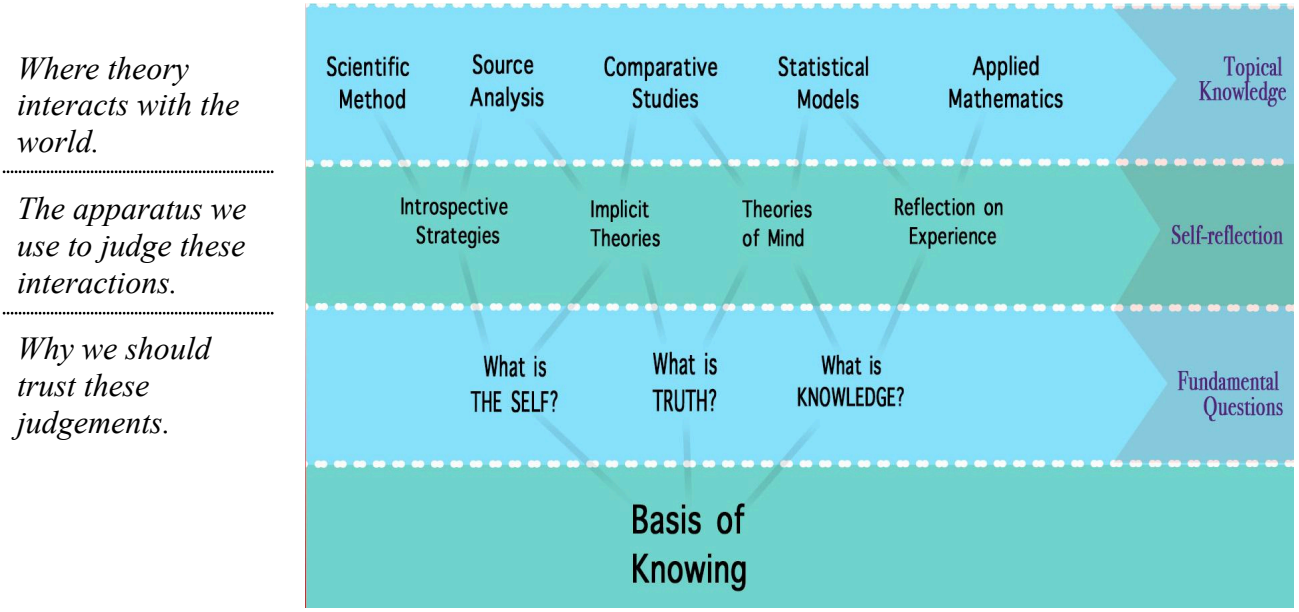
Epistemological beliefs are individual perceptions of knowledge that shape the structure of cognitive concepts and significantly influence how learners engage with and perceive information (Schommer-Aikins & Easter, 2006; Strømsø, et al., 2008). This paper explores the relationship between these beliefs, knowledge uncertainty, and academic achievement. Furthermore, we introduce a novel interventional tool grounded in philosophical discourse to stimulate deeper questioning of these beliefs.

Epistemological beliefs in education encompass a spectrum of concepts, including certainty and simplicity of knowledge, source of knowledge, speed of learning (Trautwein & Lüdtke, 2007), and even metacognitive skills and strategies such as self-critical reflection (Barzilai & Zohar, 2012) as well as domain-specific Epistemologies associated with research methodologies in the respective knowledge fields.

This broad scope of ideas and concepts can be integrated when presented at various depths of epistemological questioning. In Figure 1, we present a hierarchical model.

The highest level pertains to topical knowledge, which is the interaction of our theories with the world. The second level involves self-reflection, which encompasses assumptions about the apparatus we employ to evaluate these interactions. Finally, the deepest level contains fundamental questions that ask why we should trust the judgments of our minds and how they perceive these interactions. This conceptual model differs from the integration proposed by Weinstock (Kuhn et al., 2000). While both models acknowledge the vertical dimensionality of these topics, our model uses clear conceptual boundaries that allow for the inclusion of additional epistemological topics and does not restrict responses to only three epistemological stances.

Figure 1.



Viewing types of epistemological beliefs as existing at different depths of assumptions enables the identification of appropriate questioning of epistemological beliefs, depending on the student's individual differences and the extent to which they have scrutinised their own assumptions.

Furthermore, this hierarchical arrangement corresponds to the student's developmental progress, correlating the sophistication of epistemological questioning with age, cognitive capacity, and education level (Schommer-Aikins & Easter, 2006). A review by Muis and colleagues (2006) notes these relationships and proposes that this is explained by a form of recursive questioning that is a part of student development and which progressively deepens with age whilst being spurred by interest in a domain and change of educational structural contexts, e.g. the change from high school to university.

The Utility of Deep Questioning in Generating Epistemological Uncertainty

At first glance, one might assume that more superficial epistemological beliefs, such as topical and self-reflective beliefs, would correlate more strongly with academic success,

given their apparent direct relationship with the subject matter. However, despite the evidence indicating that domain-specific beliefs and implicit theories influence academic achievement, research suggests that deeper beliefs about the certainty of knowledge bear a closer correlation with educational outcomes. Knowledge Certainty is typically assessed using self-reported Likert scale surveys (Schommer, 1990; Hofer & Pintrich, 1997) and correlated with school and university grades.

In a study conducted by Bråten and Strømsø (2005), the correlation between Knowledge Certainty and implicit epistemological beliefs with intrinsic motivational factors was examined. The findings suggest that beliefs regarding the inherent uncertainty of knowledge were more predictive of self-efficacy, goal mastery orientation, and interest than implicit theories of intelligence. Furthermore, Kienhues et al. (2008) challenged the benefit of domain-specific epistemological development during the early stages of mastery, hypothesising that limited domain knowledge might not be sufficiently integrated to yield long-term effects. These findings align with numerous other studies that link domain-independent uncertainty with academic achievement (Lang et al., 2021; Strømsø, et al., 2008; Trautwein et al., 2007).

We suggest that knowledge uncertainty that arises from deeper questioning can affect a broader field of knowledge and further promote cognitive flexibility and coherence across a greater knowledge landscape while reducing dissonances that may arise out of segregated domain knowledge.

For example, Schommer‐Aikins and Easter (2006) found that epistemological beliefs that promote the integration of concepts and drawing cohesive relationships between ideas correlate with academic performance. In contrast, beliefs that emphasise distinguishing concepts without making connections correlate negatively with academic results. Furthermore, a study examining the correlation between integrated versus distinct conceptual boundaries and academic success found that the belief in high interrelatedness of knowledge correlated with academic success (Strømsø, et al., 2008).

Additionally, Mason & Boscolo (2004) found that students with more sophisticated beliefs are likelier to engage in deep learning strategies. These strategies include seeking multiple perspectives and integrating new information with prior knowledge, which can enhance comprehension and retention of information. Conversely, students with less sophisticated beliefs might rely more on surface-level learning strategies such as memorisation, which may not convert to true understanding of the material.

Interventions on Epistemological Beliefs in Education

Though the number of interventional studies in this area is limited, some significant studies offer insights into the relatively positive effects of epistemological interventions that employ critical thinking and refutational strategies, as well as the means by which knowledge uncertainty can be generated.

A critical thinking approach is exemplified in a study by Klopp and Stark (2022), which implemented an evaluative epistemological perspective that contemplates both thesis and antithesis. Participants were exposed to resolvable scientific controversies, with discussions steered to lead students to a predetermined conclusion. The results showed an increased evaluative approach to knowledge acquisition. However, the experiment's methodology relied on resolving epistemological doubt to effect significant change and changes to Knowledge Certainty were not measured post-intervention.

However, a study by Kienhues et al. (2008) aimed to increase uncertainty using refutational strategies to induce epistemic doubt and a change in epistemologies. Refutational instruction involves presenting students with information related to their beliefs and then providing evidence to challenge them, encouraging students to critically assess their beliefs and consider alternative perspectives. The measurements included self-reports relating to certainty and completeness of knowledge in the domain-specific area covered by the intervention material — in this case, DNA testing and accuracy — and more general beliefs about knowledge certainty. The hypothesis was that impacting domain-specific certainty beliefs would yield overall epistemic effects. The results showed that this refutational tactic effectively shifted epistemic beliefs relating to knowledge certainty and domain-specific epistemology in the short term.

Kuhn and Crowell (2011) also applied a refutational approach, facilitating class discussions via computer software and dividing students into small groups to debate opposing views. They assessed epistemological understanding using a semi-structured interview and found that students in the inquiry-based curriculum exhibited significant growth in their comprehension of the nature and limits of knowledge, including a reduction in epistemological certainty.

These interventions commonly rely on domain-specific knowledge to stimulate domain-general uncertainty. However, the mechanism for the transition of domain-specific knowledge across all domains is not built into these interventions, and expecting participants

to make these generalisations without guidance may limit the long-term effectiveness of these results (Kienhues et al., 2008).

Exploring the Power of Philosophical Questioning

We propose that subsequent interventions employ philosophical, epistemological questioning to challenge foundational assumptions, a key aspect of philosophical enquiry. This approach offers significant advantages over interrogating domain-specific knowledge, which may be constrained by embedded epistemological assumptions. For instance, the scientific presumption equates truth discovery with the ability to consistently replicate results, limiting the depth of epistemological questions that can be raised within the domain.

Applying philosophical discourse to scrutinise these epistemological assumptions carries several key benefits. Firstly, philosophy is a well-navigated field, offering a wealth of nuanced arguments and counter-arguments. Secondly, it could be contended that educators are reinventing the wheel in categorising different epistemological positions as done by Weinstock (2006) and Kuhn (2000) through multiplicitism, absolutism, and evaluativism — such course-grained labels leave little room for nuanced construction of epistemological ideas.

While some may argue that philosophical questions are inherently abstract and contradict the well-supported pedagogical methods of contextualising learning and personalising knowledge for students, in reality, standard philosophical discourse uses thought experiments that can contextualise and make relevant, valuable lines of questioning (Leng, 2020). Applying various contexts in such thought experiments can demonstrate to a student the context-independent nature of the issues discussed and generalise epistemological uncertainty across multiple domains.

Addressing Age and Cognitive Capacity in Philosophical Questioning

The appropriateness of engaging students in philosophical questioning relies significantly on their cognitive capacity, which is closely tied to their age and development. As students mature, their epistemological beliefs become increasingly sophisticated. However, at certain developmental stages, these inquiries may prove too complex or unfamiliar, necessitating a

level of prior knowledge that is unavailable to them or a more fully developed theory of mind (Weinstock et al., 2020).

Age correlations to the sophistication of epistemological beliefs continue until university, although the correlation between age and epistemological beliefs appears to reduce throughout this period (Schommer, 1998). For example, (Ordóñez et al., 2015) show a significant difference between the certainty of knowledge beliefs between university and high school age, whereas a study by (Karaman, 2017) suggests a correlation between age and certainty of knowledge becomes insignificant by the time of initial employment.

Even though younger learners may struggle with deep epistemological questioning, such questioning could have the most substantial impact while epistemological beliefs are still maturing. Given these considerations, it is reasonable to focus philosophical questioning-based interventions on late high school and undergraduate students, where they have the most potential impact. Nevertheless, by adapting the wording and complexity of the intervention materials, engaging a broader range of cognitive capacities and ages could be feasible.

Contemplating the Absence of Philosophical Discourse in Targeted Interventions

One might wonder why interventions addressing the heart of epistemological uncertainty, as found in philosophical discourse, have yet to be attempted. First, it is important to recognise that the number of interventional studies conducted in this field is notably limited. Furthermore, studies have not explicitly disclosed their reasons for employing domain-specific materials to provoke students to question broader assumptions. Nevertheless, a potential explanation could be the perceived inaccessibility of philosophy as a subject. It is a field not typically covered in standard school curricula, and many teachers may need to be more knowledgeable and prepared to facilitate learning and discussions around philosophical topics.

It is valuable to note that the intervention proposed in this study is designed to bridge this gap. It does not necessitate prior knowledge; all components are presented to teachers and students in an accessible format. The goal is to create an environment where everyone can engage freely using methodological reasoning, thereby demystifying philosophical discourse and making it integral to generating deeper epistemological uncertainty.

Introducing an Intervention Tool for Epistemological Uncertainty

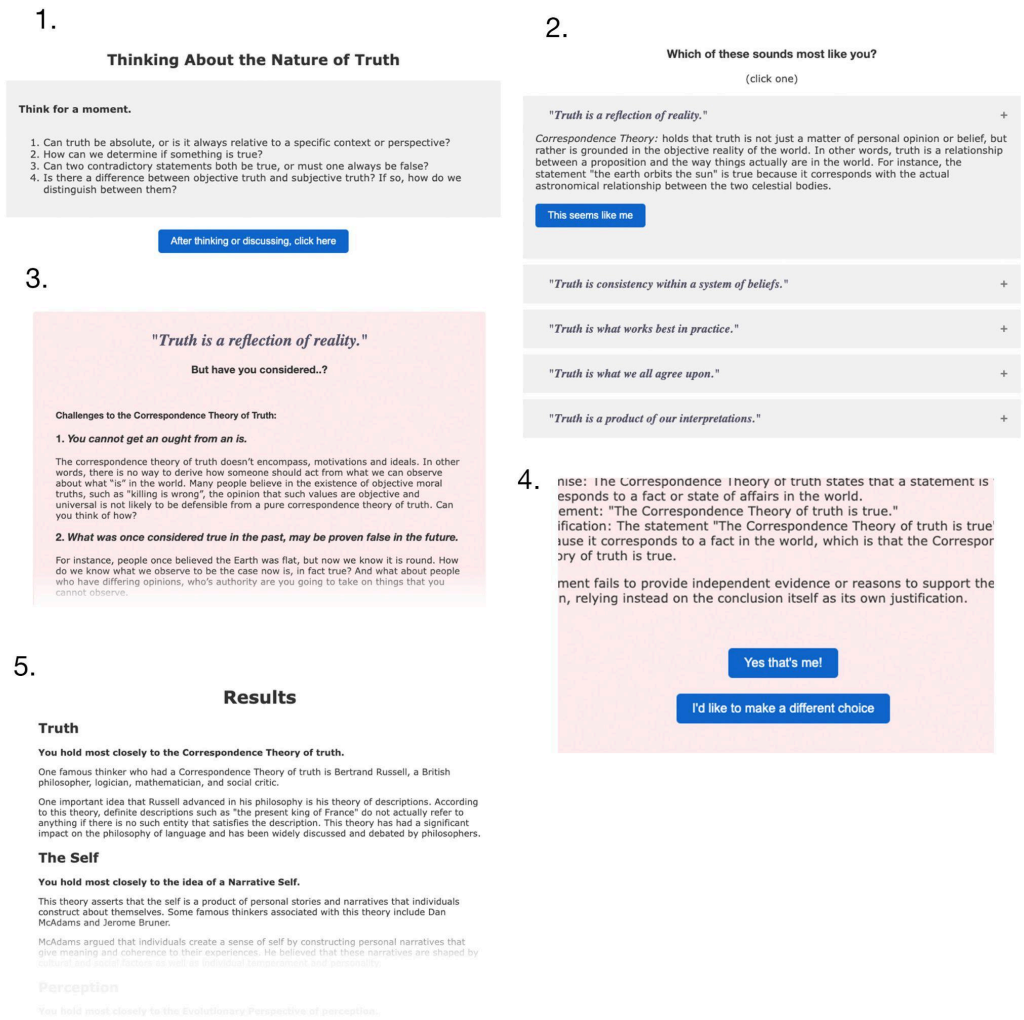
The proposed intervention has been developed as a tool and is available at whatsmyepistemology.com. The tool is a self-discovery survey, allowing students to explore their assumptions about knowledge and gain insights into their beliefs. The objective is to provoke questioning and help students understand the integral role of questioning assumptions in constructing a coherent worldview.

This tool draws inspiration from previous interventional studies, applying the method of refutation and critical enquiry, which exposes and challenges existing assumptions and has proven successful in earlier interventional studies (Kienhues et al., 2008; Kuhn & Crowell, 2011). The tool does not require prior knowledge of philosophical fields designed to be accessible to the broadest possible range of students. It is also a valuable resource for stimulating in-depth classroom discussions and debates.

The intervention tool incorporates well-established philosophical arguments, ensuring the discussions are grounded in recognised scholarly discourse. Thought experiments are frequently used to articulate arguments and bring the concepts under discussion. This tool avoids directing students toward a single solution. Instead, it fosters an environment of epistemological uncertainty. The results section provides feedback and motivation to enhance student engagement.

The subsequent section outlines the intervention stages, showing how a self-discovery survey can integrate the refutational approach to enhance Knowledge Uncertainty. Screenshots from the relevant webpage, depicted in Figure 2, illustrate these steps.

Figure 2.



1. The student is presented with an epistemological topic and asked to discuss or think about it using a scaffold of four questions to guide the discussion. In the example provided, students are encouraged to define the nature of Truth.
2. On clicking through to the next page, students are presented with a series of encapsulating quotes and are asked to identify with one of them based on what they have resolved from their prior discussion. Clicking on the quote expands it to show text articulating the position more precisely.
3. After students select a quote aligning with their perspective, they encounter counterarguments rooted in philosophical thought experiments, which underscore possible contradictions with other held beliefs. This process aims to foster uncertainty by spotlighting potential cognitive dissonances.

4. After reading through these issues, students are encouraged to reconsider their initial stance by clicking the “I’d like to make a different choice” button, returning them to the previous page. Alternatively, hold to their initial position by clicking the “Yes, that is me!” button and progressing to the next topic of consideration.
5. Once the student has gone through this process for all the topics 1) “Thinking about the nature of truth”, 2) “Thinking about the nature of the self”, and 3) “Thinking about the nature of perception”, they are presented with a result page. This page summarises their beliefs and allows them to identify with prominent thinkers of the past and present that hold to these positions.

Future Considerations

We invite third-party contributions to this tool, emphasising the importance of iterative refinement for accessibility to students at varying epistemological stages. The studies underscore the potential of domain-independent epistemological uncertainty in enhancing student success and removing barriers that prevent integrated knowledge structures and cohesive worldviews. We have also highlighted how philosophical discourse can effectively target this uncertainty. The tool we have presented incorporates effective strategies of refutation and critical engagement, balancing educational value with approachability. While future empirical research is expected to shed light on the long-term effects of this method, we extend an open invitation to educators to evaluate our tool at myepistemology.com and encourage contributions to further its potential for effectiveness.

References

Barzilai, S., & Zohar, A. (2012). Epistemic Thinking in Action: Evaluating and Integrating Online Sources. *Cognition and Instruction*, *30*(1), 39–85. https://doi.org/10.1080/07370008.2011.636495

Bråten, I., & Strømsø, H. I. (2005). The relationship between epistemological beliefs, implicit theories of intelligence, and self-regulated learning among Norwegian postsecondary students. *The British Journal of Educational Psychology*, *75*(Pt 4), 539–565. https://doi.org/10.1348/000709905X25067

Hofer, B. K., & Pintrich, P. R. (1997). The Development of Epistemological Theories: Beliefs About Knowledge and Knowing and Their Relation to Learning. *Review of Educational Research*, *67*(1), 88–140. https://doi.org/10.3102/00346543067001088

Karaman, A. (2017). Identifying demographic variables influencing the nature of science (NOS) conceptions of teachers. *Universal Journal of Educational Research*, *5*(5), 824–837. https://doi.org/10.13189/ujer.2017.050515

Kienhues, D., Bromme, R., & Stahl, E. (2008). Changing epistemological beliefs: the unexpected impact of a short-term intervention. *The British Journal of Educational Psychology*, *78*(Pt 4), 545–565. https://doi.org/10.1348/000709907X268589

Klopp, E., & Stark, R. (2022). *How to Change Epistemological Beliefs? Effects of Scientific Controversies, Epistemological Sensitization, and Critical Thinking Instructions on Epistemological Change*. https://doi.org/10.3390/educsci12070499

Kuhn, D., Cheney, R., & Weinstock, M. (2000). The development of epistemological understanding. *Cognitive Development*, *15*(3), 309–328. https://doi.org/10.1016/S0885-2014(00)00030-7

Kuhn, D., & Crowell, A. (2011). Dialogic argumentation as a vehicle for developing young adolescents' thinking. *Psychological Science*, *22*(4), 545–552. https://doi.org/10.1177/0956797611402512

Leng, L. (2020). The Role of Philosophical Inquiry in Helping Students Engage in Learning. *Frontiers in Psychology*, *11*, 449. https://doi.org/10.3389/fpsyg.2020.00449

Mason, L., Boldrin, A., & Zurlo, G. (2006). Epistemological understanding in different judgment domains: Relationships with gender, grade level, and curriculum. *International Journal of Educational Research*, *45*(1), 43–56. https://doi.org/10.1016/j.ijer.2006.08.003

Mason, L., & Boscolo, P. (2004). Role of epistemological understanding and interest in interpreting a controversy and in topic-specific belief change. *Contemporary Educational Psychology*, *29*(2), 103–128. https://doi.org/10.1016/j.cedpsych.2004.01.001

Muis, K. R., Bendixen, L. D., & Haerle, F. C. (2006). Domain-generality and domain-specificity in personal epistemology research: Philosophical and empirical reflections in the development of a theoretical framework. *Educational Psychology Review*, *18*(1), 3–54. https://doi.org/10.1007/s10648-006-9003-6

Ordóñez, X. G., Romero Martínez, S. J., & Fernández, I. R. (2015). Epistemological beliefs of colombian students according to educational and socio-demographic variables. *Acta Colombiana de Psicologia*, *19*(1), 68–78. https://doi.org/10.14718/ACP.2016.19.1.4

Schommer‐Aikins, M., & Easter, M. (2006). Ways of Knowing and Epistemological Beliefs: Combined effect on academic performance. *Educational Psychology Review*, *26*(3), 411–423. https://doi.org/10.1080/01443410500341304

Schommer, M. (1990). Effects of beliefs about the nature of knowledge on comprehension. *Journal of Educational Psychology*, *82*(3), 498–504. https://doi.org/10.1037/0022-0663.82.3.498

Schommer, M. (1998). The influence of age and education on epistemological beliefs. *The British Journal of Educational Psychology*, *68*(4), 551–562. https://doi.org/10.1111/j.2044-8279.1998.tb01311.x

Strømsø, H. I., Bråten, I., & Samuelstuen, M. S. (2008). Dimensions of topic-specific epistemological beliefs as predictors of multiple text understanding. *Learning and Instruction*, *18*(6), 513–527. https://doi.org/10.1016/j.learninstruc.2007.11.001

Trautwein, U., & Lüdtke, O. (2007a). Epistemological beliefs, school achievement, and college major: A large-scale longitudinal study on the impact of certainty beliefs. *Contemporary Educational Psychology*, *32*(3), 348–366. https://doi.org/10.1016/j.cedpsych.2005.11.003

Trautwein, U., & Lüdtke, O. (2007b). Predicting global and topic-specific certainty beliefs: domain-specificity and the role of the academic environment. *The British Journal of Educational Psychology*, *77*(Pt 4), 907–934. https://doi.org/10.1348/000709906X169012

Vogelzang, M., Tsimpli, I. M., & Williams, J. (2021). Learning rate and success as a function of code-switching strategies in the input. *Proceedings of the Annual Meeting of the Cognitive Science Society*, *43*(43). https://escholarship.org/uc/item/1591s6nh

Weinstock, M., Israel, V., Cohen, H. F., Tabak, I., & Harari, Y. (2020). Young Schoolchildren's Epistemic Development: A Longitudinal Qualitative Study. *Frontiers in Psychology*, *11*, 1475. https://doi.org/10.3389/fpsyg.2020.01475