

Epistemology and
epistemic cognition:
The problematic virtue
of relativism and its
implications for science
education

Epistemología y cognición
epistémica: la virtud
problemática del relativismo
y sus implicaciones para la
enseñanza de la ciencia

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La investigación en cognición epistémica ha demostrado que las creencias que tienen los adolescentes y los jóvenes adultos acerca de la naturaleza del conocimiento cambian a través de etapas fijas de desarrollo. Modelos propuestos en las cuatro últimas décadas han indicado, que la naturaleza de estas epistemologías personales tiende a cambiar de objetivista a relativista, y que este cambio refleja una transición ascendente en términos de complejidad respecto a la cognición epistémica. El supuesto subyacente es que la cognición epistémica cambia hacia diferentes formas de relativismo en analogía con lo que ha ocurrido a los principios epistemológicos centrales de la mayoría de ciencias en la historia moderna (e.g., física, biología). Por lo tanto, se ha pensado que gran parte del éxito de los estudiantes en la educación científica depende de cómo éstos entienden el conocimiento, considerando el pensamiento basado en ideas relativistas como un logro necesario para el aprendizaje de la ciencia. En este artículo teórico discuto acerca de la plausibilidad de estas hipótesis basándome en nociones contemporáneas en epistemología acerca de la naturaleza del conocimiento.

palabras clave: **cognición epistémica, epistemología, enseñanza de la ciencia.**

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RESUMEN

ABSTRACT

Research on personal epistemologies has shown that beliefs about the nature of knowledge and knowing in adolescents and young adults change through fixed stages of development. Models proposed over the past four decades have indicated, that the nature of personal epistemologies tends to shift from objectivism to relativism and that this shift is reflecting an ascendant transition in terms of epistemic cognition complexity. The underlying assumption is that epistemic cognition changes towards different forms of relativism in analogy to what has happened to the central epistemological principles of most sciences in modern history (e.g., physics, biology). Therefore, a large part of students' success in science education has been thought to depend on how they understand knowledge and knowing, considering relativistic-based thinking as a necessary achievement for science learning. In this theoretical article I discuss about the plausibility of these hypotheses based on contemporary notions about the nature of knowledge and knowing in epistemology.

keywords: **epistemic cognition, epistemology, science education.**

Over the past 40 years, researchers on personal epistemologies have dedicated their efforts to investigate how people understand the nature of knowledge and knowing and how these understandings seem to change according to different notions of psychological development. Starting with the results of a longitudinal study published by William Perry in 1970, a variety of comprehensive models have been proposed with the aim of mapping the inherent nature and forms of development of personal epistemologies, particularly in adolescents and young adults (Hofer & Pintrich, 1997, 2002). In this sense, the study of personal epistemologies has been divided into two main lines of research: the first of them concerning the study of fixed epistemological dimensions by which beliefs about knowledge and knowing are defined (Schommer, 1994; Schommer-Aikins, 2002), and the second regarding how these beliefs change through fixed stages of development (Baxter Magolda, 1992; Belenky, Clinchy, Goldberger, & Tarule, 1986; Hammer & Elby, 2000, 2002; King & Kitchener, 1994, 2002; Perry, 1970).

Results in both lines of inquiry have shown that personal epistemologies are directly related with variables such as gender (Baxter Magolda, 1992; Ogûz, 2008), educational background and expertise (Alexander & Dochy, 1995; Chinn & Malhotra, 2002; Samarapungavan, Westby & Bodner, 2006), learning and instruction (Chan, 2003; Hashweh, 1996), beliefs about teaching and learning (Buelens, Clement, & Clarebout, 2002; Chai, Khine, & Teo, 2006; Chan, 2004; Tsai, 2002), critical thinking (King & Kitchener, 1994, 2002), and motivation (Chan, 2003; Hofer & Pintrich, 1997). This broad investigative landscape has placed the study of personal epistemologies as one of the most promising

and influencing areas of research in education. Nevertheless, as the scientific progress in most social sciences has shown (Thagard, 1992), due to the proliferation of many different models, the particular epistemic problems they have tried to face, and the pragmatic interests of the researchers implicated, there have been various misunderstandings, disagreements, and contradictory positions regarding both theoretical and methodological foundations for inquiry in this area.

On the theoretical ground, most of the variance concerns how researchers have labeled the concept of beliefs about the nature of knowledge and knowing (Hofer, 2001), to what extent these beliefs should be considered as domain-general or domain-specific beliefs (Hammer & Elby, 2002; Hofer, 2000; Muis, Bendixen, & Haerle, 2006; Samarapungavan et al., 2006), and the conceptual boundaries of this area of research (Bendixen & Rule, 2004; Kuhn & Weinstock, 2002). On the methodological ground, there have also been some divergences. Both qualitative and quantitative approaches of data collection have been used, including open-ended and semi-structured interviews, and open-ended and structured questionnaires. All these methodological approaches have been widely criticized, especially those of quantitative character (Hofer & Pintrich, 1997).

These theoretical and methodological issues in the study of personal epistemologies deserve further discussion and clarification. However, the intention of this article, far from being an effort to document an extensive review and discussion of these issues (thoughtful reviews can be found in Greene, Azevedo, & Torney-Purta, 2008; Hofer, 2001; Hofer & Pintrich, 1997, 2002), is to discuss a conceptual issue that has often been overlooked by researchers on personal epistemologies. This issue endangers the plausibility

of one of the core assumptions supported by most models in this area of inquiry, especially those included in the second line of research commented above: The shift from objectivism to relativism as a suitable act of epistemological thinking complexity. I shall argue through this article, that a relativistic worldview, from an epistemological perspective, is neither a more suitable nor a more complex form of epistemic cognition than it is an objectivistic worldview.

THE GENERAL NOTION OF DEVELOPMENT IN EPISTEMIC COGNITION RESEARCH

According to Kuhn and Weinstock (2002), the fact that research on personal epistemologies has generated diverse stage-models has brought with it many critics regarding a lack of consistency in terms of the epistemological elements that characterize each stage of epistemic cognition development. Kuhn and Weinstock suggested that this particular issue has constrained the growth of research on personal epistemologies, and therefore proposed a general conceptualization of epistemic cognition development in order to make its study more appropriate for theoretical and empirical analysis. They suggest that:

The developmental task that underlies the achievement of mature epistemological understanding is the coordination of the subjective and objective dimensions of knowing. Initially, the objective dimension dominates to the exclusion of subjectivity [first stages]. Subsequently, in a radical shift, the subjective dimension assumes an ascendant position and the objective is abandoned [transitional stages]. Finally, the two are coordinated, with a balance achieved in which neither overpowers the other [final stages]. (p. 123)

This general conceptualization about the nature of epistemic cognition development not only makes its theoretical and empirical boundaries wider, but it also represents one of the main hypotheses

of several stage-development models. Most researchers in this particular line of research seem to support the same conception of epistemic cognition development documented by Perry (1970). The results from this research suggested that adolescents and young adults are likely to have two major types of personal epistemologies or *epistemic worldviews*: objectivism (or absolutism) and relativism (Cano & Cardelle-Elawar, 2004). Although not completely explicit, other researchers (Baxter Magolda, 1992; Belenky, et al., 1986; King & Kitchener, 1994) have also classified personal epistemologies into these same broad categories (for a complete review of these results, see Hofer & Pintrich, 1997). Moreover, they have agreed that a shift from an objectivistic to a relativistic epistemic worldview, although it does not occur dramatically, is completely plausible.

Going back to Kuhn and Weinstock (2002), it seems that at some point during the final stages of development, both epistemic worldviews (objectivism and relativism) tend to harmonize with each other and start to coexist without being in conflict. However, I consider there are two important irregularities regarding this issue. On the one hand, this ecological state of epistemic cognition has been a "friendly ghost" in research on personal epistemologies. Studies designed to explore personal epistemologies in adolescent and young adult students have found that this level of epistemic cognition is rarely observed, even in graduate students (King & Kitchener, 2002; Moore, 2002). On the other hand, even though there is an ample agreement about the existence of this "higher" level of epistemic cognition, its nature has not been clearly differentiated from lower relativistic levels (Hofer & Pintrich, 1997). In this sense, my main concern is: Does the shift from objectivism to relativism represent

an ascending transition in terms of epistemological thinking complexity?

I agree with Chinn, Buckland, and Samarapungavan (In review) and Greene et al. (2008), that in order to appropriately solve this sort of conceptual issues which have arisen from epistemic cognition research, it is fundamental to approach them from a philosophical perspective. In this sense, the questions which should be addressed are: What current models in epistemology state about the nature of knowledge and knowing and its constitutive elements? What are the epistemological foundations for those elements? Do contemporary epistemologists consider relativism as a more suitable and complex form of epistemology than objectivism? Is there something epistemologically wrong with objectivism?

CURRENT EPISTEMOLOGY AND THE PROBLEMATIC VIRTUE OF RELATIVISM

The advent of Postmodernism in the last century generated some important revolutions in philosophy, and mainly in the study about the nature of knowledge and the rationality and progress of science (Boyd, Gasper, & Trout, 1991). One of those revolutions, and perhaps the most important, started with a brisk acceptance of a *social constructivist* worldview in response to the imperialist regime of the empiricist paradigm. It was at this time when many epistemologists such as Richard Rorty, Keith DeRose, and Nelson Goodman, just to cite here some of the most prominent, began to establish the pillars of a modern anti-objectivist conception about the nature of knowledge and knowing. In other words, as Alvin Goldman recently suggested, epistemology began to be socialized (Goldman, 2009). Consequently, over the past 50 years there has been a general agreement among epistemolo-

gists about the socially constructed nature of knowledge. Sheltered by the main thesis of *epistemic relativism*, which is that "there are radically different, yet 'equally valid' ways of knowing the world" (Boghossian, 2006, p. 2), a considerable number of epistemologists began to claim that all knowledge is context and mind dependent. In other words, knowledge is historically and culturally situated, and therefore it exists because of humans. Nevertheless, not all epistemologists have received these relativistic assumptions tenderly; *epistemic objectivism* also has its reasons. The confrontation between these two epistemic worldviews, or in terms of Goldman (2009) between *veriphobes* (people who exhibit an aversion of truth) and *veriphiles* (lovers of truth), has become a central issue in current epistemology. Table 1 summarizes the main assumptions of these two epistemic worldviews.

The matter in heated discussion is: Is it reasonable to accept a relativistic worldview of knowledge and knowing as a dominant paradigm in epistemology? Paul Boghossian, in one of his most recent publications, *Fear of knowledge: Against relativism and constructivism*, gave strong arguments in opposition to epistemic relativism. He pointed out some fundamental issues regarding the main theses of two of the most influential figures of this epistemic worldview: Nelson Goodman and Richard Rorty. I will support the following discussion about the appropriateness of epistemic relativism in current epistemology, based on those issues identified by Boghossian (2006).

OBJECTIVISM STRIKES BACK

Nelson Goodman has argued that knowledge about facts represents just different versions of

the world, assuming versions as a set of descriptions. Hence, facts are description-dependent (Goodman, 1978). This implies that knowledge about a fact is possible only because it is described by humans, and in this sense knowledge is mind-dependent. This thesis is supported by the idea that if two different subjects are describing, for example, a group of trees, one of them could say that there is a fixed number of trees, and the other may say that there is a forest. Both descriptions are correct, thus an objective knowledge about that fact is not possible. Boghossian (2006) called this version of epistemic relativism as a "cookie-cutter constructivism" (p. 57). He argued, on the one hand, that the world did not begin with humans, so those facts about the world are not mind-dependent, but mind-independent (e.g., mountains). In other words, how is it possible that the cause (description) comes after the effect (fact)? Boghossian referred to this as the problem of *causation*. On the other hand, he asserted that fact-description is one thing and fact-constructivism is other quite different; description is not equivalent to construction. He named this problem *conceptual competence*. In simple words, the argument is that humans cannot construct or describe something that in fact had constructed them (e.g., electrons).

Another important criticism addressed to Goodman's theses, and which I consider is one of the most harmful to epistemic relativism in general, is the problem of *disagreement*. Boghossian put it this way: "So long as the constructions [of facts] are said to be contingent, there will be a problem about how we are to accommodate the possible simultaneous constructions of logically (or metaphysically) incompatible facts" (Boghossian, 2006, p. 41). In other terms, if no certainty exists about how a fact is likely to be constructed, how would it be possible to recognize that the

construction of that fact is representing that particular fact and not a different one?

Likewise, Boghossian also discussed other two problems for epistemic relativism, but this time by considering the work of Richard Rorty. As an alternative view to Goodman's model, Rorty claimed that facts can be causally independent of humans, but they cannot be independent of their representations. In this sense, there are different ways of representing a fact, but the nature of that fact is independent of those representations. Subsequently, the representation with the best pragmatic reasons should be considered as the best. In other words, the representation that corresponds with the needs and interest of a community is the one that represents the true nature of that fact (Rorty, 2000). Hence, knowledge is a matter of the best pragmatic reasons, which implies, similar to Goodman's position, that there are no absolute truths about facts, just different representational approximations.

In Addition to this global relativistic thesis, Rorty (2000) argued that pragmatic reasons support the structure of what epistemologists have called *epistemic systems*. These systems are groups of norms, standards, and principles that determine how different communities (e.g., the scientific community) conceive the nature of knowledge and knowing. This is what he described as *epistemic pluralism*: different contextual frameworks entail different epistemic worldviews, and all of them should be equally valid. With these ideas in mind, Rorty finally claimed that, in order to justify which representation of a fact is better than others, we should evaluate all those representations using the particular epistemic system that is ruling their configuration. Although Boghossian agreed with some aspects of this relativistic position, he argued that if there are not absolute truths, this

global relativism is incoherent by its own lights. If evidence can vary from community to community, and they have different epistemic systems, then pragmatic reasons are also different and correctly justified. Thus, there cannot be a better representation of a particular fact (Boghossian, 2006).

A NEW HOPE

In response to these and other criticisms to epistemic relativism, and also in response to its somewhat extreme epistemological assumptions, other epistemologists such as Helen Longino (1990, 1997) and Alvin Goldman (2007, 2009) have proposed new epistemic worldviews regarding the nature of knowledge and knowing. Longino is considered one of the principal exponents of a recent epistemology called *critical contextual empiricism*; a form of feminist epistemology. She argued that social values determine the way scientists conduct their experiments in order to prove a particular hypothesis, which implies that what researchers do in their experiments (e.g., observations, treatments) is determined by their own beliefs about which data can support which hypothesis (Longino, 1990). This seems to be a coherent example of a relativistic position; knowledge is justified upon pragmatic reasons and it is also mind-dependent. Nevertheless, Longino does not deny the possibility of objectivity as most relativist epistemologists have done. Instead, she claims that knowledge can be objective, but only if it is examined by various perspectives with different social values (in other words, by different epistemic systems), which should be viewed as a group of provisional alternative standards (Longino, 1997).

On the other hand, Goldman (2007) has proposed a new conception of relativism called

objectivity-based relativism. Goldman, in agreement with an objectivist worldview, claimed that there can be a unique and correct way of knowing (or epistemic system), which would control the objective justifiedness or unjustifiedness of a particular fact. However, because there can be different sources of evidence in relation to the correct epistemic system and other alternative systems, the objective justificational status of the knowledge about that particular fact cannot be uniform, but varied. In this sense, the correctness of an epistemic system depends on the objective justificational status of a particular piece of evidence.

CONCLUSIONS

RECONSIDERING OBJECTIVISM AND QUESTIONS FOR FURTHER DISCUSSION

Summarizing, I have identified what I consider are three major worldviews about the nature of knowledge and knowing in current Epistemology: epistemic relativism, epistemic objectivism, and a new epistemic objectivity-based relativism. These epistemic worldviews represent quite different discourses about the nature of knowledge and knowing, and thus, the dispute among them has been without truce. However, at the end of the day, the same questions remain: Which of them should be considered as more "adequate" in order to understand the nature of knowledge and knowing? Does epistemic objectivism have been abandoned by Epistemologists? Does epistemic relativism is a more "rational" form of epistemology?

Although answering the first of these questions is beyond the scope of this essay, answers to the second and the third are instantly recognizable. Objectivism is still considered a prevailing form of knowledge and knowing in current epistemology.

Paraphrasing Juan Ignacio Pozo when he discussed the contemporary status of behaviorism in psychology (Pozo, 1999), if epistemic objectivism is considered to be dead, its ghost seems to be quite alive! Moreover, if we go back to the discussion about the plausibility of relativism, it seems clear that this form of epistemology has to overcome various difficulties before it can be considered as a rational way to understand the nature of knowledge and knowing.

With these ideas in mind, the questions that I consider should be addressed for further discussion are: What do these new epistemologies suggest for the study of personal epistemologies? Is there something wrong with objectivism as a personal form of knowledge and knowing? Could it be plausible to think, from a traditional conception of development, that a relativistic personal epistemology is a complex and advanced stage of epistemic cognition? Have scientists, perhaps one the most preponderant exponents in the search of knowledge, discarded objectivism in their daily work? Does the construction of scientific knowledge demand a relativistic position? And in this sense, what are the implications of these assumptions for science education?

IMPLICATIONS FOR SCIENCE EDUCATION: "THE PHANTOM MENACE"

One of the characteristics that researchers on epistemic cognition have pointed out as distinctive of a personal objectivist worldview is the remarkable weight that is given to authority (Hofer & Pintrich, 1997). If we look at the structure of research articles in many respectable social science journals, it is common to see two or more references per paragraph, which in most cases are used to inform other researchers about what has or has not been done in a particular domain.

Nonetheless, sometimes bibliographical references are used to give enough credentials to the study, for it to be validated and accepted by the scientific community. As Thomas Kuhn (1996) suggested, to survive the scientific enterprise it is required to be "normally obedient". Of course, this is not the only purpose of referencing sources of research in an article; scientific coherence is also necessary. Nevertheless, it seems that scientists frequently rely on authority when they attempt to achieve knowledge in their domains.

Another example in the daily work of scientists that shows how they rely on objectivism as a suitable form of knowledge and knowing is concerned with the sometimes desperate use of cumulative evidence in order to capitalize scientific progress. Larry Laudan (1977) has argued that one of the main intellectual aspirations that scientists have held in the last century, that is the rationality of scientific knowledge, relies on "the universal assumption that progress can occur only if it is *cumulative*, that is, if knowledge grows entirely by accretion" (p. 6). In terms of progress, the history of large number of sciences has been supported by the well known notions of *generalization* and *replication* of knowledge, which are subordinated to this idea of knowledge accumulation. The slogan seems to be always the same: "The more evidence you have, the best your science is". This shows how objectivism has played an important role in the epistemic scheme of science. Objectivism is not only a "living form" of epistemology; it is also the milestone of current science.

Contextualizing the discussion above, results on personal epistemologies seemed to have suggested to researchers, educators, and policymakers that the shift from objectivism to relativism in epistemic cognition development is a desirable

experience for high school and college students in order for them to achieve academic success (Chan, 2004). Sheltered on the assumption that the general notion of knowledge and scientific progress in the last century has evidently suffered a transition from objectivism to relativism, research on personal epistemologies could be “pushing” science education to rely on relativistic thinking achievement as a critical academic goal. In other words, for students to understand current scientific knowledge they are expected to develop relativistic notions about the nature of knowledge and knowing.

Could it be asserted that students who embrace objectivist forms of epistemic cognition are less likely to succeed in science education contexts than those who embrace relativistic ones? Should it be appropriate to encourage students to develop relativistic conceptions about knowledge and knowing in science, considering that most current scientific endeavors do not seem to rely on this form of epistemology? Researchers, educators, and policy makers should not demand students to learn a science that is, from an epistemological perspective, no more than a desirable ideal. They should not understand students’ epistemic cognition development in terms of a suitable shift from objectivism to relativism, which, as I have discussed above, seems to be far from appropriate. Perhaps, they should first try to understand the very nature of science and epistemology before attempting to understand students’ personal epistemologies. Perhaps, they should not conceive objectivism as a “phantom menace”, and start considering not only its philosophical strengths but its undeniable role in the science scientists currently do.

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Table 1
Main Assumptions of Epistemic Relativism and Epistemic Objectivism

| Epistemic Relativism | Epistemic Objectivism |
|--|--|
| <p><i>Non-normativeness:</i> There are no universal truths about facts; they are socially constructed.</p> | <p><i>Normativeness:</i> Not all truths about facts vary across societies, most of them are universal.</p> |
| <p><i>Equal validity principle:</i> There is no wrong epistemic system or way of knowing.</p> | <p><i>Absolutism principle:</i> There is a uniquely correct epistemic system; all incompatible systems are wrong.</p> |
| <p><i>Context-dependency:</i> Knowledge is historically and socially constructed.</p> | <p><i>Context-independency:</i> Knowledge is a priori of human experience.</p> |
| <p><i>Mind-dependency:</i> Facts exist because of humans</p> | <p><i>Mind-independency:</i> A fact is a fact is a fact.</p> |
| <p><i>Pragmatic reasons:</i> Knowledge is justified by the interests and needs of a particular community.</p> | <p><i>Epistemic reasons:</i> Knowledge is justified by the evidence available.</p> |