Critical Contextual Empiricism and its Implications for Science Education

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This paper attempts to analyse the Critical Contextual Empiricism (CCE) proposed by Helen Longino. I have examined some of the recent criticisms against CCE by K L Freedman and have attempted to defend Longino's position. I have suggested that Longino's understanding of science has important implications for science education.

Keywords: Critical contextual empiricism, Objectivity, Contextual values

Introduction

In this paper, I attempt to make an exposition of the objectivity of science as it is viewed in Critical Contextual Empiricism (CCE) proposed by Helen Longino (1990 & 2002) and will examine some of the criticisms raised against this account by K L Freedman (2009). I will argue that Freedman's criticisms against Longino's position are not strong. Freedman has made two important charges against the epistemological position which Longino maintains: i) it is relativistic; and ii) this account faces serious problems since she does not give an explication of the realist position she maintains. I will argue that both of these claims are problematic and involve misinterpretations of Longino's view. The second section provides a brief account of objectivity as maintained by Longino. The third section presents charges on Longino's account of objectivity raised by Freedman. Fourth section examines these criticisms on the account of objectivity raised by Freedman, and reveals some of the misinterpretations and limitations of Freedman's arguments. In the fifth section, I show the implications and relevance of Critical Contextual Empiricism (CCE) in science education. In the last section, I provide a few concluding remarks.

Objectivity

According to Longino, scientists are primarily concerned with objectivity of method. Longino argues that objectivity of science, thus understood, is secured by the social character of enquiry. To attribute objectivity to science is to claim that the view provided by science is one achieved by reliance upon non-arbitrary and non subjective criteria, for developing, accepting and rejecting hypotheses and theories that make-up the view. According to Longino, two shifts in perspectives make it possible to see how scientific method or scientific knowledge is objective in the contextualist account. One shift is to consider science as practice, and another is to regard scientific method as something practiced not primarily by individuals but by social groups. Longino's claim is that objectivity of scientific inquiry is a consequence of the inquiry being 'social' and not an individualistic one. What is called as a piece of scientific knowledge is produced by a community and it transcends the contribution of any individual or even of any sub-community within the larger community. *"Once propositions, theories, hypotheses are developed, what will become scientific knowledge is produced collectively through the clashing and meshing of a variety of points of view"* (Longino, 1990, p. 69). Longino points out two aspects of science which makes it public and hence ensures the possibility for it to be objective. Science has a common language. This helps to understand each other's descriptions and hence to accept or reject hypotheses and to make objections. This makes the discursive interaction possible and hence objectivity.

The presupposition of objects existing independent of our perception of them imposes acceptance of constraints on what can be said or reasonably believed about them. Such acceptance implies the relevance of reports and judgements other than our own. Since we are talking about objects which are existing independent of us, our understanding of them need not be "the understanding." And hence we have reason to pay attention to others' views. This realist presupposition adds weight to the 'objectivity' which Longino talks about. By posing this kind of a realist account, Longino mediates between philosophers and sociologists' account of 'objective knowledge'. It is the possibility of intersubjective criticisms that permits objectivity in spite of the context dependence of evidential reasoning. The criticism regarding the relevance of evidence is crucial to the problem of objectivity. These criticisms amount to the questioning of the background beliefs or assumptions on the basis of which states of affairs become

evidence. Objectivity, considered in this sense, requires a way to block the influence of subjective preferences at the level of background beliefs. *"While the possibility of criticism does not totally eliminate subjective preferences either from an individual or from a community's practice of science, it does provide a means for checking its influence in the formation of scientific knowledge"* (Longino, 1990, p. 73). Background assumptions get criticised. As a response to criticisms one may modify the background assumptions. Or if the original proponent does not do so, someone else may do it as a way to enter into the discourse. Criticism is thus transformative.

According to Longino, as long as background beliefs can be articulated and subjected to criticisms from the scientific community, they can be defended, modified, or abandoned, in response to such criticisms. Hence the incorporation of hypothesises into the canon of scientific knowledge can be independent of any individual's subjective preferences. Their incorporation is instead, a function in part of the assessment of the evidential support. It has to be noted that, 'objectivity' then is a character of a community's practice of science rather than of an individual.

Longino thinks that the "networks of relations" that are involved (among other individuals, social systems, natural objects, natural processes etc.) are not to be understood as an "obstacle" to knowledge, but should be understood as "rich pool of varied resources, constraints, and incentives" to help to close the gap left by logic. Longino says that philosophical concern with justification is not irrelevant, but must be somewhat reconfigured in order to be made relevant to scientific inquiry. This configuration comes through the view that knowledge, which is social in nature, needs to have a social norm for its justification. Many might think that the solution offered by a social account of knowledge is worse than the problem. But Longino argues that this misunderstanding is a result of accepting a false dichotomy between the rational/cognitive and social. Critical discursive interactions are social processes of knowledge production. They determine what gets to remain in the "public pool of information" that counts as knowledge. Thus a normative account of knowledge must rest on norms governing such interactions. Longino has offered social norms for knowledge. She has argued that criticism from different points of view is required for objectivity. This criticism limits the role of idiosyncratic subjective preferences in scientific knowledge. Objectivity thus construed is a matter of degree. According to Longino *"A method of inquiry is objective to the degree that it permits transformative criticism"* (Longino, 1990, p. 76). Objectivity consists not just in the inclusion of intersubjective criticisms but in the degree to which both its procedures and its results are responsive to the kinds of criticisms raised. This is the reason why Longino argues that method must be understood as a collection of social rather than individual processes. The following are the social norms for a scientific inquiry offered by Longino. These norms secure the objectivity of knowledge claims as well as method.

a) Venues - There must be publicly recognised forum for the criticism of evidence, methods, assumptions and of reasoning. Critical activities have a central role to play and have to be considered as important (or at least having nearly the same importance) as that of the "original research". *"As Mill argued, criticism not only spurs evaluation and re evaluation of hypotheses, but also leads to better appreciation of their grounds and of their consequences"* (Longino, 2002, p. 129).

b) Uptake - There must be uptakes of criticisms. This standard does not require that individuals or research groups capitulation to criticisms, but that community members pay attention to and participate in the critical discussion taking place and that "the assumptions that govern their group activities remain logically sensitive to it". Uptake is what makes criticism part of constructive and justificatory practices. Uptake is bidirectional since it is not the case that only the community should be responsive, but the claims of advocates of a line of criticism must also take account of those criticisms.

c) Public standards - There must be publicly recognised standards. Theories, hypotheses and observational practices are evaluated on the basis of the reference to these standards. Criticisms are made relevant to the goal of the inquiring community on the basis of these standards. *"Participants in a dialogue must share some referring terms, some principles of inference, and some value or aims to be served by the shared activity of discursive interaction"* (Longino, 2002, p. 130). Thus, shared elements are necessary for the identification of points of agreement, disagreement and for resolving a disagreement and for destabilising an agreement. Standards are not a static set but may themselves be criticised and transformed, in reference to other standards, goals, or values held temporarily constant. There is no particular act of adopting or establishing standards. Rather they come to operate as such in the same ways that content is accepted as knowledge.

d) Tempered equality[1] - A diversity of perspectives is necessary for epistemically effective critical discourse. This criterion aims at making sure that the economic power or social position of an individual or group in a community ought not to determine, who or what perspectives are taken seriously in that community. Where consensus exists, it must be the result of critical dialogue in which all relevant perspectives are represented. Every member of the community should be regarded as capable of contributing to its constructive and critical dialogue. The point of the requirement is to ensure the exposure of hypotheses to the broadest range of criticism.

Criticising Objectivity

According to Freedman (2009), apart from 'methodological objectivity', objectivity in the sense of the way the world is,

has an important role in CCE. In this account, objectivity (understood as "getting the world right") is a key consequence of inquiry. According to him, the position of feminist epistemologists - under the label he includes Longino also - maintain that one can access 'the way the world is' not through the elimination of subjective preferences, but because of those preferences. For him, the argument that cognitive values such as simplicity are partially social is acceptable[2]. But he thinks that the idea that certain social or political values such as 'diversity' are epistemic in part is problematic.

According to Freedman, if 'objective' is shorthand for whatever survives the criticisms of a diverse group, then a gap opens between an objective theory (or hypothesis) and one that conforms to reality. In that case it is not clear what reason do we have to think that objectivity construed in this way is epistemically desirable. He emphasizes that the kind of objectivity thus construed by Longino is epistemological and not methodological or ontological. According to him, this is very evident by Longino's statement that critical discursive conditions of knowledge production are effective for achieving conformation. Since Longino sees 'conformation' as the end of inquiry, just consensus is not enough to have objective knowledge. In her account, objectivity is achieved, if a theory or hypothesis survives the critical scrutiny of a community which met the standards of the community. According to Freedman, this account of objectivity is relativistic. He adds that the history of science is replete with examples of community wide acceptance. Many of those accepted theories turned out to be false. With the lessons from the history of science he reminds us that convergence is no guarantee of truth or conformation, regardless of the make-up of the group who is doing the converging.

Freedman holds that tempered equality can help to democratise science but not for "conformation" as Longino intends. As we saw earlier, diversity of views, according to Longino, is one of the aspects of inquiry to ensure objectivity. Freedman agrees that she is correct to suggest that diversity in a community of scientific inquirers helps to ensure that "unchecked" values do not make their way into scientific theories. In Longino's view, this "purification processes" – as Freedman calls it – is that which turns the 'subjective' into 'objective'. But Freedman criticises that, the 'objectivity' which Longino talks about amounts to 'intersubjectivity'. He also claims that Longino is inconsistent in her account. Longino maintains that when interactions are effective, they transform the subjective into objective. This objectivity is not attained by canonising "one subjectivity over others", but by assuring that what is ratified as knowledge has survived criticisms from multiple points of view. Freedman points out that Longino rejects the idea that objectivity is achieved by canonising one set of subjective preferences over all others. According to Longino, objectivity demands the survival of one's view from criticism from different viewpoints. Freedman says *"Objectivity, on this view, is akin to intersubjective agreement and verifiability, which sounds very much like the canonization of one set of subjective preferences; namely the one that we get greatest consensus on"* (Freedman, 2009, p. 51).

Freedman points out that if we want the result to be a publicly verifiable content that hooks onto the world, then we need something to fill the gap. Longino is aware of this problem and she introduces an account of realism to meet this problem. In Longino's account, what purportedly guarantees a more robust sense of objectivity as a result of the diversity of criticism is realism. The realism which Longino invokes is pluralist realism. Freedman is aware that Longino's locution 'conformation' is wide enough to capture the features of pluralist realism. This locution is broader than the notion of 'truth'. It not only enables to capture the non-linguistic content of science but also helps to accommodate multiple kinds of epistemic success. "Conformation" admits of degrees and respects, which opens the door for the possibility of pluralism of conforming content about the world.

Freedman argues that Longino's commitment to realism is not a consequence of her contextual empiricism but is a presupposition of it. In her account, realism acts as a link that connects tempered equality and objectivity. He claims that indeed it is her commitment to realism that explains her belief that diversity of critical interaction in a scientific community will generate results that approach truth or conformation and avoid falsehood. Realism is what rules out the likelihood of a community affecting itself to wrongheaded standards or false theories. This is what will ensure that the plurality of conforming content will not be inconsistent, contradictory or mutually exclusive.

Assessing the Criticisms

According to Freedman, the position of feminist epistemologists, including Longino, maintain that one can access 'the way the world is' not through the elimination of subjective preferences, but because of those preferences. But of course this is not the position of Longino. She construes objectivity as it stands in opposition to subjectivity. According to her, for the attainment of objectivity, subjective preferences have to be mitigated or eliminated. The fact that Longino takes the subjective viewpoints seriously is no reason to say that she holds subjective preferences as a sufficient means to get the world right. As we have already seen, the reason why she takes the subjective viewpoint seriously is not by thinking that subjective viewpoint alone will help us to have access the world, but on the contrary, it is to make sure that diverse points are available which will help to eliminate idiosyncratic subjective views and thus to attain objectivity. This is a clear case of misinterpretation of Longino's view.

Longino's account becomes a relativistic one, only if one assumes an absolutist notion of knowledge. But Longino's argument is that 'evidence' devoid of context is not possible. Evidence does not make sense in isolation (from contexts) and hence, knowledge thus construed is context dependent. In fact, CCE mediates between an absolutist and relativistic conception of knowledge and is a "third way"[3] to approach knowledge. Freedman thinks that the social norms for knowledge provided by Longino are relativistic. In regard to these norms Freedman says, history of science gives us plenty of examples which are fulfilled by the normative criteria of the community but turned out to be false. But, from the viewpoint of Longino one might say that even those theories can be considered as partial representation of the world which is true in specific ways and is false in specific ways. According to Longino, if one wants to count the community's acceptable theory as knowledge, one should treat knowledge as provisional, partial and context dependent. Longino warns that one who disqualify knowledge as having the above mentioned features will have to pay a high price for it. Such a position will lead to the elimination of theories and models as objects of knowledge. It will lead one to consider only the observational data as the content of knowledge. To make the situation worse, arguably, in an important sense data too are provisional and partial. Different theoretical frameworks can make different data, different assumption of data or different aspects of the data salient. Different statements about observation will be meaningful and relevant in different theoretical contexts[4].

One serious criticism from Freedman concerns the realist position which Longino adopts. Freedman is right to say that her account of realism is not a consequence of her other positions, but a presupposition of them. Freedman suggests that Longino does not give an account of realism, which she presupposes. However, Longino herself has made it clear that the realist position which she maintains is a presumption. As I have pointed out in the previous section, she maintains this view to explain the importance of multiple points of view in ensuring the objectivity of method. I think Longino is taking this realist notion as a basic one, based upon which her other positions are explained. One might be able to say that realism should be seen as a background assumption and should not be even considered as a theory.

Freedman thinks that the reason why Longino is able to call the agreement of the community fulfilling the criteria of discursive interaction as 'knowledge' is due to the "external check" of the world on wrongheaded assumptions and therefore she is not justified for not giving an account of realism which she maintains. As far as I understand, in Longino's position the "check" of wrongheaded assumptions need not be *only* by the external world. Knowledge productive communities have mechanisms to prevent a situation in which 'anything goes'. Longino says *" ...although the social approach does not offer a single standard of justification, it does have a mechanism for ruling out the endorsement of epistemic standards whose adoption, like 'Believe what is false' or 'Believe what you feel' would undermine the chance for a community and its members to attain their goals. Critical discursive interaction can undermine such wrongheaded rules when logic and data, in case of underdetermination cannot"* (Longino, 2002, p. 161).

As Longino has pointed out, two things are supposed in the claim that critical interaction eventually results in the weeding out of wrongheaded standards. One is that the conditions of critical discursive interaction are satisfied. The other is that any community of embodied agents will have among its cognitive interests, an interest in accurate descriptions of its physical environment. The standards developed to secure those interests will always be available as a resource for those engaging in critical interaction with (or in) that community. Longino adds, "I am not averse to saying that regard for logic and for the evidence of sensory experience are universal features of knowledge constructive community, even partially constitutive of such communities. But because of the particular forms of logic and of experience may vary, this is not to say very much" (Longino, 2002, p. 162). However, her claim is not that logic and experience are subsumed by the success condition. Instead she holds that the terms of success condition for embodied subjects require adherence to some logical standards and some standards of sensory evidence. Thus they do not allow counterlogical or countersensory rules.

Implications for Science Education

Critical Contextual Empiricism (CCE) has several implications for science education. As we have already seen, CCE stresses on the importance of criticisms and the inclusion of as many viewpoints as possible for the attainment of objectivity of method as well as knowledge claims. These features of CCE should be taken as a role model for science education as well. In the present day "text book culture" of science education, criticism and the inclusion of various viewpoints do not enjoy a level of importance which it should. Very often science education is considered as, at least by many, learning the theories and trying to replicate the results in the laboratory. This kind of a science education does not help one to appreciate the spirit of science. Science grows through criticism. Science classes should encourage criticisms and inclusion of different viewpoints. For the criticism and the inclusion of various viewpoints to be effective, it should be ensured that science classes maintain tempered equality and uptake of criticisms. This will make science education a more objective process.

CCE throws light upon the ineliminable social nature of science. Often science is considered as knowledge claims embodied in text books. By realising the social (understood mainly as interactive) elements of science we should stress on this aspect

of science in science education. As it has been stated above a little differently, an attempt to replicate the actual practice of science in science classes also can be useful to understand science and its social elements in a better way. This attempt will help one to come out of the dogma of an individualistic conception of science. It should be clear that science education should be conducted as the actual practice of science; i.e., through an interactive mode.

In an average science class, there is a tendency to think that theories in science are 'exact descriptions' of the world; in other words, theories attempt to make a one to one correspondence relation with the world. As we have seen in the earlier portion of this paper, Helen Longino's pluralist realism helps us to consider theories in science as 'models'. Models can never be an exact description of the world. If a model is an exact description of the world, then it ceases to be a model. (Think about maps. If a map is an exact description of the portion of the world it is being mapped, then it ceases to be a map). Models are right in specific ways and are wrong in (some other) specific ways. As it is in the case of models, theories in science also have a goal of helping one to interact with the world. Just like models, description is not the only aim of theories in science too. This view towards theories in science should help science education for not spreading the misconception that theories in science are the exact descriptions of the world.

Conclusion

In this paper, I have made a brief exposition of Longino's view of objectivity as developed in her account of Critical Contextual Empiricism (CCE). I have considered some of the criticisms raised against it by Freedman. I have shown some of the misinterpretations made in criticizing Longino's account, and have also argued that these criticisms do not undermine the account of CCE provided by Longino. I have suggested that Longino's account of Critical Contextual Empiricism (CCE) has important implications for science educations and it provides us many lessons for science education.

Acknowledgements

Thanks to Dr. Prajit K. Basu, (Reader, Dept. of Philosophy, University of Hyderabad, India) for carefully reading several drafts of this paper and for his valuable suggestions.

Notes

[1] Longino has made it explicit that though this criterion has resemblance with Habermas' account of truth it is not intended to give an account of truth. This account provides a criterion which distinguishes legitimate consensus from illegitimate consensus.

[2] Thomas Kuhn's (1977) famous article *"Objectivity, value judgement, and theory choice"* played an important role towards this move.

[3] Philip Kitcher (2002) criticised Longino's position in his paper entitled *"The third way: Reflections on Helen Longino's The fate of knowledge"*.

[4] Longino says "The measurement of contemporary astronomers may prove to be useless to astronomers of the twenty-fifth century as the earlier measurement are to the former".

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