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The epistemology of constructivism

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ABSTRACT

Constructivism has become one of the major influences on present day science and mathematics education and is increasingly exerting a major influence in other areas of education as well. Its central tenet can be defined in terms of the proposition that knowledge does not exist independently of the subjects who seek it, and in this sense it constitutes a human construction recognising the active capacity of the cognising subject. Stated in such a general way, it is difficult for those not familiar with the history of epistemology to understand the significance of such a viewpoint, or to understand why it might be contentious. In this paper, my aim is to attempt to make clear constructivism's distinctive epistemological basis, to contrast it with alternative approaches to learning and knowledge, to consider criticisms levelled against it, especially from realist quarters, and to assess the overall strengths and limitations of the approach. Firstly I will seek to define constructivism' s epistemological focus. Then I will consider its strengths and weaknesses by reviewing several criticisms of the approach.

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What is constructivism?

Lerman (1989), following Kilpatrick (1987), presents the core epistemological propositions of constructivism as

- Knowledge is actively constructed by the cognising subject, not passively received from the environment.

- Coming to know is an adaptive process that organises one's experiential world; it does not discover an independent, pre-existing world outside the mind of the knower.

Contained within these propositions are others that: knowledge is personally and socially constructed (Miller and Driver, 1987); knowledge is 'made' rather than 'discovered' and interpretative categories are prior to facts (Hacking, 1990); truth is 'provisional' rather than 'certain', and 'limited' rather than 'foolproof' (Confrey, 1990); and rather than revealing an objective, independent world, knowledge gives us 'constructs' or 'frameworks' by which we make sense of experience (Glasersfeld, 1984; Kelly, 1955).

The emphasis on the *active construction of knowledge* constituted a reaction to the mindless empiricism and to various forms of behaviourist psychology of the 1920s and 1930s. Such constructivist views can be seen embodied in the works of Piaget, in much post-positivist philosophy of science; in the work of Kant, more recently in the philosophical writings of Nelson Goodman and Hilary Putnam; in the Barnes-Bloor school of Edinburgh sociology of knowledge; in the individualist psychology of George Kelly; and in Vygotskian language theory (Matthews, 1992; Hacking, 1990).

Constructivism thus constitutes a healthy antidote to those various forms of grey materialism including positivism and empiricism as well as Marxism and behaviourism which seek to deny the productive canons of discourse, the centrality of interpretative structures of science, the theory-dependence of observation, and the efficacy of mind in the active quest for knowledge.

In that this paper seeks to outline what is central to constructivism, it should be pointed out at the outset that the constructivist movement comprises a heterogeneous grouping of types including those claiming to be 'radical', 'social', 'sociohistorical', 'pragmatic', 'Piagetian', to name a few (Wandersee and St Julien, cited in Tobin, 1993). For the purposes of this paper, constructivism is defined as a movement with its origins in developmental psychology, originating with the work of Jean Piaget and receiving its contemporary expression in the radical constructivism of Von Glasersfeld and others.

For radical constructivists, all understanding and all communication is a matter of interpretative construction on the part of the experiencing subject. Such a claim involves a rejection of metaphysical realism which entails the view that our knowledge is a knowledge of the world independent of the knowing mind. This was the dominant view in epistemology, as Hilary Putnam (1981) reminds us, before Kant and after the pre-Socratics. It involved a conviction that truth was always tied to some notion of objective validity and the claim that something is true only if it *corresponds* to an independent objective reality. It constituted a form of *direct* realism in the Aristotelian tradition representing the world as directly apprehended by the knowing mind, and a form of *indirect* realism amongst the empiricists of the seventeenth century who saw the world as apprehended only in terms of 'ideas', 'impressions', or 'sense data'.

Constructivism differs radically from these traditional conceptualisations and the radical difference concerns the relation of knowledge to reality. Rather than searching for a *correspondence* or *match* between mind and the world, the constructivist searches for a *functional adaptation* or *fit* between new knowledge and prior experience, placing a much greater emphasis on the ability of the human mind to construct and impose categories on the world.

This was essentially Kant's thesis in *The Critique of Pure Reason.* Rather than view reality as mind-independent and as something 'discovered' by the scientist, Kant held that our mind does not derive laws from nature but imposes them on it (Von Glasersfeld, 1984: 20). Kant had opposed the central assumptions of a genuinely Newtonian psychology grounded in observation, experiment and general laws. The mind, for Kant, unlike Locke, altered itself in the very act of knowing. Rather than being a tabula rasa or blank slate, at the foundations of Kantian rationalism are 'a priori categories' of pure understanding; those necessary conditions of mind in which experience itself is grounded. Through his conceptual analysis Kant sought to demonstrate that a tabula rasa

psychology was self-contradictory, for unless certain rational categories are posited a priori, neither 'experience' nor 'mental association' is even possible. The former takes place in space, the latter in time, and neither space nor time is itself an object of experience. Hence, the problem Kant addressed was that if observation is theory-dependent, from where do our initial theories come to enable observation? Because to argue that they themselves derive from experience would be circular, Kant argues, for a priori categories. To use the idiom appropriate to this paper we might say that Kant required a cognitive psychology as the precondition for an empirical psychology. Even more he drew attention to the structural and formal dimensions of thought which must be understood if sense is to be made of the contents of thought.

Scepticism

It is doubts about the existence of a correspondence between know ledge and the world that defines constructivism as a *sceptical* position in relation to epistemology. Scepticism in relation to knowledge has existed since the time of the pre-Socratics and effectively denies that we can ever be sure that our perceptions constitute knowledge of an objective world, or that our knowledge faithfully corresponds to the world as it really is.

In the seventeenth century Descartes, although he sought ultimately to establish a secure foundation for knowledge in the 'cogito', challenged our common sense beliefs as to the existence of an external world, maintaining that such beliefs could be the result of dreams, delusions, or even of a malicious demon. In pre-Socratic Greece Xenophanes said that no one has ever seen certain truth for even if one were to see or say something that was completely certain and sure, one would nevertheless be unaware of the certainty of it. One could never be sure that a proposition was not mere opinion for "opinion is fixed by fate upon all things" (cited in Freeman, 1948: 33).

Metaphysical realism has been a dominant position in epistemology throughout western history. The extent to which our knowledge is an accurate reflection of a mind-independent world has thus set the stage with a dilemma that has affected western epistemology ever since the time of the pre-Socratics in the sixth century BC. In rejecting realism, constructivist theories of learning adopt a sceptical position. They reject "the a priori assumption that objective knowledge constitutes a description of that which is known" (Glasersfeld, 1984: 26). They thus reject the scenario by which people can have knowledge of an independent world, and they reject the view that the quest for know ledge is concerned with finding out about real processes and structures. The sense that reality is always actively constructed by mind, mediated by interpretative frameworks, or framed by what Xenophanes called 'appearance' and 'semblance', is thus fundamental to constructivist theory. The fallibility and unreliability of the human senses are reasons for doubting the reliability of knowledge and its correspondence with a mind-independent world. This is the doubt of Xenophanes, Descartes, and Kant. A second more serious doubt concerns the reliability of the human senses. It disputes objective structure of the real world and questions the epistic validity of a correspondence between our experiential world and the 'world-in-itself. This view follows Kant' s doubts as to whether our experiences of the world can teach us anything about 'things in themselves', and if not, how can we explain that we can still experience the world as stable and reliable.

While constructivists deny the possibility of knowledge of the real world, they do not deny the existence of the world itself. In this sense, it is an epistemological rather than an ontological thesis. It agrees with the sceptics that the only world we can have is the world of our experience. As Confrey (1990: 108) states,

> Put into simple terms, constructivism can be described as essentially a theory about the limits of human know ledge, a belief that all knowledge is necessarily a product of our own cognitive acts. We can have no direct or unmediated knowledge of any external or objective reality. We construct our understanding through our experiences, and the character of our experience is influenced profoundly by our cognitive lens.

Within this framework, traditional (realist) conceptions of truth are replaced by conceptions such as 'viability' (Glasersfeld, 1993) which have meaning only within an experiential context. This issue distinguishes constructivism from pragmatism. Whereas for constructivists the real world remains unknowable, no matter how well we manage in the domain of experience, for pragmatists truth, assessed instrumentally in terms of 'what works', assumes a more traditional meaning in relation to standard theories of representation or reference.

In emphasising the constructed dimension of knowledge, the way it is 'made' and ' put together', constructivists build on the work of Vico, Kant, and Berkeley, pre-empting an emphasis given to knowledge this century by writers such as Dewey, Bridgman, Ceccato and Piaget. For all of these thinkers, the world we experience is necessarily constructed by ourselves, and it is because of this that its features are relatively stable and reliable. Constructivism's most fundamental epistemological principle is that the world which is constructed is an experiential world that consists *only* of experiences and makes no claim whatsoever about 'truth' in the sense of a correspondence to an ontological reality. Following Kant, constructivism holds that the mind actively processes the raw material of sensory impressions and the objects of knowledge produced are called *experience* which is organised in terms of constructs put together by individuals as they operate upon the world. For the constructivist, it is not the objective world that limits or constrains what can be experienced or known, but rather the prior 'construct' or 'component' of experience which defines truth in terms of 'coherence' or ' consistency'.

The emphasis Kant gave to the active mind in interpreting and imposing structure on reality can be seen to foreshadow the emphasis given in education to pupil-centred activity and problem-centred learning, and of understanding the students conceptual orientation to knowledge acquisition and the role of cognitive processes that constitute the essential basis on which learning takes place.

In emphasising the role of consciousness in actively producing knowledge, constructivism can be seen as radical on the very ground that it breaks with the convention of the more traditional realist approaches to knowledge, developing an epistemology in which knowledge represents an 'ordering' and 'organisation' of events constituted as our experience. For constructivism the foundation of cognition is adaptation which serves the organisation of the experiential world rather than the discovery of real processes and structures (Glasersfeld, 1989: 182). The process by which knowledge is constructed by the learner is portrayed as a self-referential process whereby cognitive schemes are brought into play and assessed in terms of their 'fit' with an individual's prior experience.

The concept of *experience* is frequently employed by constructivists. Such a concept performs the function, it can be suggested, of dissolving the dualism between mind and world, inner and outer, in order to minimise the epistemological consequences of denying cognitive representationism and advocating a constructionist view. For Von Glasersfeld, the notion of experience stands in for a ' banished reality', and it is on this basis that he replaces the concept of ' truth', which he claims has realist implications, with the notion of ' viability', which does not refer to anything outside the experiential field. The predictions of science, says Glasersfeld, are the predictions of experiences (1993: 27); hence we have *experiential reality* (ibid.). Truth comes down to an 'act of faith ' (ibid.).

While constructivism champions the idea that knowledge is constructed by the knower, it departs from a Cartesian conception of mind and self. For Descartes, the mind was very much an ontological given, a 'thinking thing', as Descartes called it (res cogitans), with a separate existence from the body and the material world in its own right (res extensa). It was an entity with an independent existence capable of logical reasoning. For constructivists, on the other hand, "the 'I ', the agent that does the constructing, is itself a construct" (Glasersfeld, 1993: 27). The obvious circularity in this argument is something which worries philosophers but not cyberneticians, says Glasersfeld (1993: ibid.).

Piaget and Kelly

The radical constructivist has thus relinquished metaphysical realism once and for all and is in agreement with Piaget when he says that " intelligence organises the world by organising itself' (Glasersfeld, 1984: 24). Influenced by Kant, Piaget had a major influence on constructivism. In Piagetian research knowledge schemes are seen to evolve as a result of progressively more complex interactions with the world. This results in old schemes evolving into new schemes resulting in new knowledge replacing old knowledge. Within this model the development of children's reasoning is represented in terms of evolution through a series of theory changes (McCloskey, 1983; Carey, 1985; Karmiloff-Smith, 1978).

For Piaget the organisation of knowledge is the result of interaction between an organism exhibiting a conscious intelligence and the environment, an interaction which in terms of the biological theory that directs his research Piaget characterises as 'adaptation'.

The extent to which Piaget is completely compatible with a constructivist as opposed to a realist position is somewhat contentious, however. As Glasersfeld (1984: 24-25) puts it,

> With regard to the basic question, how cognitive structure or knowledge might be related to an ontological world beyond our experience, Piaget' s position is somewhat ambiguous. Frequently one has the impression that, in spite of his massive contributions to constructivism, he still has a hankering for metaphysical realism. In that of course, he is not alone. Donald Campbell, who has provided an excellent survey of 'evolutionary epistemology' since Darwin writes, "The controversial issue is the conceptual inclusion of the real world, defining the problem of knowledge as the fit of data and theory to the real world .... " In his conclusion he then declares that the evolutionary epistemology, which he and Karl Popper represent, is truly compatible with an advocacy of the goals of realism and objectivity in science.

For Glasersfeld, Piaget's theory of assimilation and accommodation points in the opposite direction and the concept of 'adaptation' is incompatible with the realist conception of a correspondence between knowledge and reality.

Kamii (1978) maintains that Piaget was a constructivist along slightly different lines because he held that (1) all knowledge is constructed by the individual as he/she interacts with the environment and tries to make sense of it, and (2) all knowledge is acquired not by the internalisation of some outside given meaning but by the construction from within of appropriate representations and interpretations. Similarly West and Pines (1984) suggest that Piaget's ideas regarding assimilation and accommodation fit very comfortably within a constructivist position.

Another major influence upon constructivist thought has been Kelly's (1955) *Personal Construct Theory.* Kelly's view is that each person constructs for himself/herself a representational model of the world which enables that person to chart a course of behaviour. Kelly's notions of 'personal constructs' and 'representational models' have been utilised by researchers such as Wittrock (1974a, 1974b) and Osborne and Wittrock (1983) in the development of the concept of *generative learning.* The fundamental premise of 'generative learning' is that people tend to generate perceptions and meanings that are consistent with their prior learning. The generative learning model stresses learner-centred education and has been a central emphasis in constructivist approaches.

The educational implications of constructivism

Constructivism maintains what is known cannot be the result of the passive acquisition of knowledge but that knowledge originates as the product of an active subject's activity or 'operations' on the world. The concept of *operations* was used by Vico and Piaget, and also has resonances associated with many of the concepts and ideas that philosophers like John Dewey developed. It is through 'operating' that experiences are organised. The acquisition of knowledge

requires the active engagement on the part of the knower who uses prior knowledge to construct new understandings. This means that knowledge does not exist independently of knowers; it is a human construction, or as Glasersfeld (1989: 182) expresses it, "knowledge is actively built up by the cognising subject".

Constructivism assumes that all cognitive activity takes place within the experiential world of goal-directed consciousness. The goals are those produced by a cognitive organism who evaluates their experiences, and in evaluating them, tends to repeat some and avoid others. Consciousness for the constructivist is *purposeful.* The concept of *purposiveness* ensures the establishment of regularities in experience are attainable and also ensures the sense of coherence and consistency which defines individual identity. It is this active nature of mind which has to be built. Piaget uses the concepts of 'equivalence' and 'individual identity' and describes how the individual child builds, as every normal child does within the first two years of life, a sense of identity and a sense of continuity. No less constructed, says Glasersfeld (1984: 35), are the judgements of 'sameness' and 'difference' in the realm of perceptual object.

> 'Sameness' is always the result of an examination with the regard to specific properties. Two eggs may be considered the same because of their shape, size, or colour, or because they came from the same hen, but there will be a pungent difference between them if one was laid yesterday and the other six weeks ago. A field mouse and an elephant are different in many ways, but they will be considered the same whenever we want to distinguish mammals from other animals .... In these cases, as in all conceivable ones, it should be clear that the criteria by means of which sameness and difference are established are criteria which are created and chosen by the judging, experiencing subject and cannot be ascribed to an experience-independent world.

It is the subject's *active operating* that gives rise to regularities and invariances in the experiential world, as well as to judgements of sameness and difference - which are always relative and are known as a result of comparisons made within the experiential field. Through the resulting experiences, a consciousness constructs *structure* which comes to be experienced as 'reality' and is given the status of an independently existing world. As Johnson-Laird (1983: 156) put it,

> Human beings ... do not apprehend the world directly, they posses only internal representations of it, because perception is the construction of a model of the world. They are unable to compare this perceptual representation directly with the world - it is their world.

The educational interest in constructivism thus studies how subjects *operate* in ways to construct a stable and regular world through their experience. In more specific terms, it has relevance to the following specific dimensions in relation to education.

1. It implies a specific theory of concept formation, perception and learning.

2. It constitutes a theory of the way science develops and is validated and legitimated.

3. It has theoretical implications for the way that teaching proceeds, how children should be treated, how classrooms should be organised, how curricula should be planned, developed and implemented and even for the broader purposes of schooling (Matthews, 1992).

The overall influence of constructivism in relation to educational studies has been substantial. While a full survey of its applications is beyond the scope of this paper, it is worth illustrating the diversity of its uses in relation to various aspects of educational research.

Reading - seen as involving the active use by the reader of 'mental constructions' or 'schemata' in interpreting what is on the page (Anderson, 1984; Schank and Abelson, 1977).

Problem solving - research indicates that problem solvers first construct a representation (Newell and Simon, 1972; Green, 1978; Larkin, 1983).

Science education - research shows that students' conceptions of natural phenomena can be seen as examples of particular types of models or mental representations, in this case of the natural

world, which in turn influences the way future interactions with phenomena are constructed (Driver et. al., 1985).

Learning theory - specifically the generative learning model has profound implications for learning, in the emphasis given to learner-initiated activity and exploration (Magoon, 1977).

Curriculum studies - rather than comprising 'that which is to be taught' , or as a list of knowledge and skills to be taught to learners, it puts the emphasis on what learners bring to their learning situations (Driver and Oldham, 1986).

Teaching - the teacher not seen as a didactic 'presenter of knowledge', but as a 'provider of experiences'.

Constructivist implies that learning outcomes depend upon the prior knowledge and interests of the -learner, and involves the 'construction' of meanings in a continuous and active way (Driver and Bell, 1986).

Critiquing constructivism

In the twentieth century, emphasis on the 'constituted' nature of knowledge has resulted in constructivists taking an approving attitude to many of the central epistemological developments in post-positivist philosophy of science, especially those that can be broadly grouped as 'theory dependence of observation'. Drawing on the work of Suppe (1977), Brown (1979) and Garrison (1986), the following propositions of the 'theory-dependence' thesis are summarised by Matthews (1994).

1. Observational statements are always dependent upon particular theoretical systems for their expression.

2. The distinction between observational and theoretical terms in a theory can only be made on pragmatic grounds, not on epistemic grounds.

3. Observations are theoretically dependent or determined; what people look for is determined by what they want to see or regard as relevant to investigation.

4. Theories are always *under determined* by empirical evidence, no matter how much such evidence is accumulated. For any set of data, any number of theories can be constructed to have that data as an implication; for any data points on a graph, any number of curves can be drawn through them.

5. Theories are immune from empirical disproof or falsification because adjustments can always be made to their auxiliary assumptions to accommodate the discordant evidence; there can be no crucial experiments in science.

The theory-dependence thesis of post-positivist philosophy has led in a number of different directions, and not all post-positivists have adopted the anti-realist position of radical constructivism. The argument that anti-realism is not logically entailed by 'theory dependence' is an argument maintained by Matthews (1992). According to him, there· is no *necessary* divorce between the *theory dependence of observation* and *realism*, and the belief amongst constructivists that knowledge does not tell us about the real world at all but simply about how our experiences can be organised stems from an inability to separate itself from empiricist and positivist assumptions. According to Matthews, while constructivism points correctly to a major error in empiricist theories of knowledge, emphasising the theory-dependence of observation, the view that this entails an anti-realist position, as believed by constructivists like Glasersfeld, and Osborne and Wittrock, is simply a mistake. To accept that (1) 'because the mind is active in knowledge construction', does not entail (2) 'that we cannot know reality'. Stated another way, because reality is always *discursively mediated,* this does not necessarily mean that we must abandon our ontological commitments to a

real world. Matthews points out that the first proposition ('mind is active in knowledge construction') is *psychological* while the second proposition ('we cannot know reality') is *epistemological* and that (1) does not entail (2).

While the argument by Matthews may well be correct, the precise case as to how 'theory-dependence' and 'realism' could be rendered compatible would need to be argued.[1] In the absence of such an argument it is not surprising to see an orientation such as constructivism, which is premised on theory dependence and which advocates the constitutive nature of knowledge, also maintain an anti-realist position in epistemology. It is an anti-realism which has substantial implications for education and which, in my view, constitutes its major weakness. Not only does it mean that issues to do with curriculum content are down played in relation to the learner's orientation to knowledge acquisition, but the sceptical foundation, which means that the attempt to understand a world external to human beings is abandoned, constitutes a problematic position which leads invariably to *idealism,* as well as to *relativism* with respect to all forms of knowledge and learning.

In relation to educational issues such as *assessment,* for instance, the implications of constructivism are far-reaching and have yet to be squarely faced. In their influential article *The Generative Learning Model,* Osborne and Wittrock (1985) report the study by Cosgrove, Osborne and Tasker (1983) who describe an eleven year old girl as persistently holding to her views about current flow in electric circuitry in opposition to the accepted scientific views. Cosgrove, Osborne and Tasker (1985: 79) ask

> Should she be given a high mark for her intellectual efforts? We think so. Should she be given a low mark because she has yet to fully accept the scientists views? Many assessment systems would do this and so encourage the student to pay lip-service to the specialists view irrespective of her level of understanding or acceptance of it.

To assess students on individual constructions discounting accepted scientific truth or even accepted normative practices within a community runs the risk of encouraging what might be called 'scholastic solipsism' reinforcing the students definitions of the situation in contradistinction to objective social and scientific necessities. In relation to the view espoused by Cosgrove, Osborne and Tasker above, it would be impossible for teachers to adopt such a view on assessment as a general operating principle. There might in fact be dire consequences if teachers rewarded students perceptions in relation to many issues - that live electric currents are harmless, or that it is possible to exit from the tenth floor of a multi-storeyed building by jumping from the window. Those who endorse sceptical epistemologies conveniently draw examples from contexts which do not confront the constraints enforced by the existence of the external world.

In an attempt to address the criticisms relating to idealism, Glasersfeld (1993: 27) reminds us that constructivists do not deny the existence of the real world. What they deny is that we can have knowledge of the real world, but idealists maintain, he says, that 'mind and its constructs are the only reality'.

In practice constructivism faces difficulties since the epistemological and ontological claims are not easy to separate. Firstly, even if we accept that constructivism does not deny the existence of a real world, it is a claim that must be accepted *on faith* for, given the constructivists' views on knowledge, it is a claim we can never know. Secondly, of more seriousness, is that given their views on the impossibility of 'real' knowledge, it is impossible to say that any 'particular structure' of the world can be said to exist.

The issue as to the 'grounds' for teacher assessments and evaluations becomes more complex when we learn that Glasersfeld's rejection of realism is motivated in part so as to destroy the possibility of such criteria existing in the first place. In answer to the question "What harm is there in remaining a realist?", he replies "No harm at all, as long as you don't tell others that the reality you have co structed is the one they ought to, or worse, must believe in" (Glasersfeld, 1993: 26). This

statement not only seems to undermine any justification for appropriate teacher direction based on legitimate epistemological criteria, but would also seem to undermine the justification for students believing in anything external to themselves as well.

Even for empiricists like Bacon, Locke or Hume there was an assumption that a real material world lay behind the 'ideas' or 'sense impressions'. There was the possibility, in theory, of assessing distorted, incorrect, or even 'ideological' representations of the real, which in turn became the benchmark for the ability to evaluate adequate from inadequate educational experiences, or valid from invalid knowledge. Without any epistemological commitment to the constraints of the real world, but only a criteria of assessing adequacy in relation to the 'fit' between our new know ledge and our past experiences, there exist no criteria by which to judge the adequacy of experience between different groups. This undoubtedly would produce a relativistic situation where each group would have equal claim to represent their particular views or knowledge as valid. While such tolerance may be possible in relation to morals or religious values, in relation to science or truth, or even political principles, it is often not possible.

In all meaningful senses constructivism must be seen as an idealist position in relation to the curriculum, as regards the emphasis given to method and learner activism over the content of what is taught, or in relation to the issues of assessment and evaluation. According to Tobin (1993), "if a teacher regards the constructions of any individual to be unviable in the larger set of contexts in which actions are to occur, it is the teacher's duty as a professional to structure learning environments to facilitate the process of learning what society regards as having the greatest viability at the time". Similar advice is given by Von Glasersfeld (1993) who maintains that a teacher can orient a learner in a general direction and prevent the learner from "constructing" in directions that "seem unsuitable to the teacher".

Given that there are no independent epistemological criteria in terms of 'truth' by which to anchor their assessments, the types of directions provided seem from a sociological point of view to be suspiciously functionalist. Is the criterion simply 'what the teacher thinks?', or is it 'the wisdom of the elders', or perhaps the 'current orthodoxy' in the community. Whichever it is, such guidance seems hardly indubitable, nor likely to encourage innovation or change. Why should the community's 'constructions' be preferable to those of the individual learner? In the absence of any commitment to knowledge of a real world, the appeal to standards based on such things as 'the views of the teacher' , 'tradition', or 'group experience' seem open to criticism in terms of what functionalist theories of society have always been criticised in terms of: their conservativism.

Individualism

While some versions of social constructivism, such as those working in the tradition of Vygotsky, for instance, cannot be identified as being ' individualist', those writing within the currently popular tradition of radical constructivism (such as Von Glasersfeld, working in the Piagetian tradition) tend to describe the processes of learning and knowledge acquisition in educational contexts in highly personal and individualistic terms which neglects the important senses in which science is a social and historical activity and ignores as well the social and communitarian dimensions of cognition. Learning should be understood as social, and individual cognition should be seen as a derivative from social cognition (O'Loughlin, 1992). Individuals learn concepts and theories already existing in the culture. Concepts and theories of science exist as real objective entities or structures. It does not mean that individual learning is not important in the process of knowledge acquisition. It is individuals who modify and change existing structures of knowledge. It is important to recognise both the social and communitarian dimensions as well as the individual and personal dimensions of knowledge acquisition. By representing learning in highly individualistic terms constructivism fails to distinguish the *theories of science* as well as the *objects* of science as *real structures* that exist and shape the learning and educational experiences of subsequent generations of students.

Constructivism is thus similar to positivism and empiricism in conceptualising the processes of knowledge acquisition in highly individualistic terms. This is partly because radical constructivism emanates from psychological theoretical origins rather than sociological ones. In conceptualising science in this way they neglect the sense in which individualistic understanding, as Durkheim amongst many others has pointed out, is parasitic upon the cultural and historical domains. For epistemological objectivists like Matthews (1992), critical realists like Bhaskar (1990), or even more 'mainstream' philosophers of science like Popper (1972b), education and learning should be represented as a process of induction of individuals into the world of theory, and into an understanding of real processes, structures and mechanisms. For realism, whether that of the critical realists, or of Popper, aims at making sense of *the world,* and not just in building constructs to guide us through *'our world'* or enable us to understand *'our experiences'.*

The individualism of radical constructivism derives in large part from the Kantian conception of the constitutive subject. Kant's conception, seen as valuable in emphasising the active and inventive aspects of knowledge acquisition, can be criticised for overemphasising personal or individual agency in the development and acquisition of knowledge. In proposing that the subject constitutes his/her own experience, Kant implicitly attributes agency to each and every individual to constitute the rules by which the subject structures their experience by bringing the data and sensation to manageable order. Such a view was criticised by Heidegger (1967) for failing to take cognisance of the facts (1) that much knowledge is passively taken in by accepting large parts of ready-made experience, (2) that coming to know something lies not simply in the conceptualisation that an act brings about but in the background of accepted beliefs that make it possible, and (3) that not all of these background beliefs can be of the subject's own making.

Radical constructivism similarly exaggerates the role of *agency* in learning. It can be argued that much of the child's learning in school is not 'constructed' through their own conceptualisation of the material but via training and conditioning. In this way the child absorbs much of what is learnt from the outside environment. Learning must in cases be accepted on *trust* without actually having to acquire it. This is so concerning the background beliefs and practices of science. As Larmore (1981: 114) puts it,

> Trust makes possible among other things, the cumulative character of modern scientific enquiry, the ability of the scientist to use the results of others without having to spend time in repeating them.

It can be argued that while the person's structuring capacities may be involved in understanding the information, or in accepting it, what makes it possible to accept it on trust is that such knowledge is *true.*

The Kantian constructivist may respond that although at any particular time things must be accepted on trust in order for an act of understanding to be possible, those accepted beliefs themselves arose from previous acts of constitution in which the subject did organise the experiences they express. The argument would be that, in the last analysis, everything that figures as part of learning derives from the structuring of the subject.

Various arguments could be mounted against this response, however. Even if we do have a priori categories that enable us to 'make sense of, and in this weak sense 'constitute' our experience, this is a far cry from saying that each individual does (and therefore should) 'construct' their experience, or that *all* learning is through active 'construction' of experience. While we can agree that it is through perception that the world is apprehended, radical constructivism moves to a much stronger claim when it argues that perception constructs the objects of experience.

To the extent that constructivism makes claims that are valid or interesting, it is invariably the forms of social constructivism associated with Vygotsky or Foucault, and not the forms of radical constructivism, which represent the process of knowledge acquisition in highly individualist terms. In Foucault's sense, constructivism is achieved by historically evolved discursive systems (eg.

psychiatry) which 'construct' the reality they posit in the sense that the ontological status of objects of concern (eg. states of mind) cannot be divorced from the conceptual matrix through which they are apprehended. While such claims constitute a strong constructivist programme, they are more relevant, I would suggest, as a social thesis and not as a claim about individual learning. Further, they are relevant only in relation to *some* knowledge claims. As Ian Hacking (1985) reminds us, strong constructivist claims are a nonsense when applied to ordinary physical objects of the material environments. No one would claim, for instance, that perception constructs objects like horses or cows.[2]

Conclusion

In addition to overemphasising individual agency, I have argued in this paper that a chief difficulty with the constructivist idea of 'making sense' or ' constructing' experience is that in the end it leads to *idealism* and invariably to *relativism,* as it is impossible to say that one view of the world or of the state of society is any more valid than any other. For realists, the aim of science is to gain understanding and knowledge *of the world,* in order to claim that the world is one way rather than another. As a consequence, in the realist model, education focuses not on the 'learner-directed' methods, but rather on inculcating appropriate critical strategies in order to facilitate a 'truer' understanding of the state of the world.

The constructivist may respond that we only start off with what interests the student in order to lead them to better and more appropriate views regarding science and society. This is, of course, acceptable as far as it goes. It is the further steps taken by radical constructivists that entail *anti-realism* and *individualism* that are problematic. As the basic constructivist position does not, as Matthews (1992) argues, strictly entail anti-realism, it may be possible to preserve the many valuable insights it contains by reconstructing it along more acceptable (realist) lines. This would, of course, be something quite different to what the radical version of the doctrine, as presently defined, claims to represent.

Notes

1. Matthews doesn't argue the case through satisfactorily but concentrates on maintaining the negative case that theory dependence does not logically entail an anti-realist position. A good example of someone who does argue such a case is Hacking (1985), and a different but related view is given by Davidson (1985).

2. Hacking (1985) says that to hold the thesis that perception constructs these sort of objects would necessitate an extreme (and extremely untenable) form of nominalism.

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