Less Familiar Pathways in Constructivism

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Abstract

Beginning as an art movement in Russia in the early parts of the twentieth century, constructivism has encompassed many domains of knowledge. Accordingly, many varieties of constructivism have appeared in the literature, so much so that some authors have gone on to dub constructivism a 'veritable jungle'. The five major varieties such as philosophical constructivism, sociological constructivism, Piagetian constructivism, radical constructivism, and social constructivism are like well travelled highways, widely talked about and discussed in literature. In the present paper we make an effort to bring into focus some of the less discussed varieties of constructivism. Though they are like less travelled streets compared to their major counterparts, they lead to new destinations, and explore new dimensions of knowledge acquisition and cognition.

Introduction

In the current scenario constructivism offers a more realistic approach to the process of knowledge acquisition than behaviourism. However, unlike behaviourism, constructivism appears in a large variety of forms (good et. al. 1993; Phillips 1995; Geelan 1997; Jha 2009), some more prominent than the others, Ernest (1995) goes on to say that there are as many varieties of constructivism as there are researchers. Riegler (2003) finds constructivism a 'veritable jungle'. Some of the different varieties of constructivism are elaborately discussed in the literature whereas others are less pronounced. The latter varieties far outnumber the former in terms of perspective and field of application. Here we shall focus on these 'minor' varieties of constructivism and their significance. If we consider the major

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varieties of constructivism as well travelled highways, the minor varieties may appear like less familiar streets. However, the latter lead to new destinations with distinctive ambience.

To appreciate these less discussed forms of constructivism a brief account of the historical development of constructivism and its major varieties is in order.

Constructivism: A Historical Perspective

The term 'constructivism' appears to be Russian in origin (konstruktivizm). According to *The Oxford Dictionary of Difficult Words* (2002, p. 95): "Constructivism is a style or movement in art in which assorted mechanical objects are combined into abstract mobile structural forms. The movement originated in Russia in the 1920s and has influenced many aspects of modern architecture and design". *The New Encyclopaedia Britannica* (1985) elaborates: "Constructivism, Russian artistic and architectural movement that was first influenced by Cubism and Futurism and is generally considered to have been initiated in 1913 with the "painting reliefs" – abstract geometric constructions – of Vladimir Tatlin. Antoine Pevsner and Naum Gabo joined Tatlin and his followers in Moscow, and upon publication of their jointly written Realist Manifesto in 1920 – they became the spokesmen of the movement. It is from the meanifest that the name Constructivism was derived: one of the directives was "to construct" art. Because of their admiration for machines and technology, functionalism, and modern industrial materials such as plastic, steel, and glass, they were also called artist-engineers."

Thus the term 'constructivism' seems to have originated in the field of art and architecture. But it has exerted a lot of influence in many fields of knowledge and learning. However, the basic connotation of the term across the fields remains– "to construct".

Historically, the tenets of constructivism, as used in the field of knowledge, are said to have emerged as early as the sixteenth century in the writings of Giambattista Vico or Giovanni Battista Vigo (1668-1744), an Italian philosopher. Her proposition of 1710, *verum esse ipsum factum* ("true itself is fact" or "the true itself is made") is taken as an early instance of constructivism epistemology. The proposition states that truth is verified through creation or invention and not through observation as taught by Descartes. It is also translated as: "The human mind can know only what the human mind has made" (von Glasersfeld 1995, p. 21). von Glasersfeld (2000) also quotes Giambattsta Vico thus: "God knows

the world, because He created it, human beings can know only what they themselves have made", and then adds: "The treatise form which this statement is taken, is the first constructivist manifesto." According to Noddings (1990) constructivism also emerged from the works of Ulric Neisser (act psychology), and Noam Chomsky (innate linguistic structures of mind).

Major Pathways in Constructivism

The major traditions have been identified in constructivism. These are (i) philosophical constructivism, (ii) sociological constructivism, and (iii) educational constructivism.

Philosophical constructivism probably originated in the ancient Greek philosophy with Socrates' (469-399 BC) 'dialogue' in which he asked directed questions leading his pupils to realise for themselves the weakness in their thinking. More recent origins of constructivism may be seen in George Berkeley's (1685-1753) philosophy of science, the philosophy of lmmanuel Kant (1724-1804), Thomas Kuhn's (1922-1996) *Structure of Scientific Revolutions* (1962), and Richard Rorty's (1931-2007) *Philosophy and the Mirror of Nature* (1979). The philosophical view of constructivism revolves around the concept of materialism vs. idealism and the debate concerning whether the world is *knowable or unknowable* (Afanasyev 1980). According to philosophical view of constructivism our beliefs and perceptions of the world are actively constructed (not discovered) by us on the basis of our experiences and active processes of developing knowledge rather than through a passive reception of sense data. This basic principal of philosophical constructivism in fact governs all other kinds of constructivism.

Experts in the history of science, philosophy of science, sociology, anthropology and computer science often indulge in the debate concerning the role of social factors in scientific advancement relative to retaional, empirical and other scientific factors. This has led to the notion of *sociological constructivism*. According to sociological constructivism the progress of science and technology, and the generation of the public body of knowledge are due to changing social conditions and interests. It argues that all knowledge is constructed and interpreted socially in the frame of science and technology studies. Though the physical world is not socially constructed, our knowledge of the physical world is socially constructed in the sense that interpretation of the sensations coming through our sense organs is socially negotiated, constructed and accepted by people

interacting with each other. The changes in theories and philosophical commitments of science are not directly linked to the explanatory power of cognitive content and rational reasoning. The sociologists treat the individual mind as a 'black box' whose inputs are sociological concerns and outputs are in the form of statements of belief which may be true or false. Three varieties of sociological constructivism have resulted from different schools of thought (Boudourides 1998): *strong* form, *mild* form, and *actor-network theory* (ANT).

Educational constructivism is concerned with knowledge construction in teaching-learning situations including classrooms. It is also known as *psychological constructivism* (Phillips 1995) and has two categories: (a) *personal constructivism*, and (b) social *constructivism*, depending upon whether an individual or a group is involved in the process of construction. Personal constructivism in turn is supposed to have two version: (i) *Piagetian constructivism* or *cognitive constructivism* due to Piaget and (ii) radical constructivism due to von Glasersfeld. Social constructivism is ascribed to Vygotsky.

Piagetian constructivism, ascribed to Jean Piaget (1896-1980), simply means that knowledge is not passively passed on by the teacher to the learner, but is actively constructed by the learner. In this connection Piaget (1970, pp. 57-58) says, "What remains is construction as such, and one sees no ground why it should be unreasonable to think it is ultimate nature of reality to be in continual construction instead of consisting of an accumulation of readymade structures". Piaget's stages of cognitive development support constructivism.

Ernst von Glasersfeld proposed radical constructivism both as a theory of knowledge and as a guide for science and mathematics education (von Glasersfeld 1984, 1987, 1993, 1995). In radical constructivism the traditional philosophical view of realism according to which knowledge has to be a representation of the objective world that is independent of human experience is abandoned. The stand taken by the radical constructivists is that knowledge is something which is *personally* constructed by an individual in an active way, as she tries to comprehend and organise her experiential world. Knowledge construction is an evolving and self-regulatory process, and it is impossible to know the extent to which knowledge reflects an *ontological reality*. The term 'ontology' refers to 'the science that deals with the principles of pure being' or 'that part of metaphysics which deals with the nature and essence of things', von Glasersfeld justifies the name *radical constructivism*

in the following lines: "Radical constructivism, thus, is *radical* because it breaks with convention and develops a theory of knowledge in which knowledge does not reflect an 'objective' ontological reality, but exclusively an ordering and organisation of a world constituted by our experience. The radical constructivist has relinquished 'metaphysical realism' once and for all." (von Glasersfeld 1987, p. 199)

Lev Vygotsky (1896-1934), a leading Russian developmental psychologist, is the propounder of social constructivism. In it he brings to focus the role of the society in the process of knowledge acquisition by a learner. According to him *collaboration* is the key in knowledge construction. Vygtosky introduced the notion of the '*Zone of Proximal Development*' (ZPD) (Vygotsky 1978) which is defined as the intellectual potential a child acquires when assisted by a knowledgeable adult or a more advanced peer. ZPD is to be distinguished from the actual domain of development of the child and can be a true measure of the child's achievement. Interactive communication needs to involve guided interaction that should enable the child to reflect critically on their conceptions and go for necessary changes. Social constructivism views individual knowledge and social knowledge to be one and the same. It suggests that construction of knowledge is facilitated by the vast cultural repertoire of artefacts, ideas, assumptions, concepts and practices which an individual inherits or born into. Thus, learning is a form of *cultural apprenticeship*.

Less Familiar Types of Constructivism

While the above five categories namely philosophical constructivism, sociological constructivism, Piagetian constructivism, radical constructivism, and social constructivism are considered the major types of constructivism, with their numerous followers, there are many other types of constructivism mentioned in the literature though to a lesser extent. Each of them has its own significance and utility, gleaned from the literature. The list, however, may not be exhaustive, *(i) Communal constructivism, (ii) Computational constructivism, (iii) Constructionism, (iv) Contextual constructivism, (v) Critical constructivism, (vi) Cultural constructivism, (vii) Cybernetic constructivism, (viii) Dialectical constructivism, (ix) Didactic constructivism, (x) Empirical constructivism, (xi) Human constructivism, (xii) Information-processing constructivism, (xiii) Mathematical constructivism, (xiv) Methodological constructivism (xv) Moderate constructivism, (xvi) Physical constructivism (xvii) Pragmatic social*

constructivism (xviii) Psychiatric/Therapeutic constructivism, (xix) Rational constructivism, (xx) Realist constructivism, (xxi) Sociocultural constructivism, (xxii) Socio-historical constructivism, (xxiii) Sociotransformative constructivism, (xxiv) Trivial constructivism, (xxv) Weak constructivism.

A perusal of literature suggests that some of the above forms of constructivism are not readily accessible. In view of this we now briefly introduce 19 of the above list of 25 forms of constructivism.

Communal Constructivism

B. Holmes et. al. introduced the term *communal constructivism* in 2001 in view of the increasing influence of Information and Communication Technology (ICT) and networked learning on knowledge construction and sharing. In this model, apart from developing their own knowledge base, students and teachers involved may be thought of as members of a kind of community who help one another in generation and sharing of knowledge making use of ICT. Communal constructivism thus suggests a way of converting the principles of social constructivism into practice in teaching-learning situations. In the words of Holmes et. al. (2001), "What we argue for is a communal constructivism where students and teachers are not simply engaged in developing their own information but actively involved in creating knowledge that will benefit other students. In this model students will not simply pass through a course like water through a sieve but instead leave their own imprint in the development of the course, their school or university, and ideally the discipline."

Computational Constructivism

Computational constructivism is based on neural basis of cognitive development. Its proponents are Quartz, and Sejnowski (1997) and Westermann (2000).

Constructionism

As a variant of constructivism, constructionism (Papert 1991, 1993) emphasises that in order to learn about abstract concepts it is necessary for a learner to create and experiment with 'artifacts'. A link between this view and that of the original Russian connotation of constructivism may be seen. Today constructionism may be facilitated by computers. Thus, besides being an active constructor of knowledge, a learner needs to go for particular constructions of the subject that are external and shared, thereby bringing understanding and experience together.

Contextual Constructivism

An individual constructs her knowledge *upon a foundation or in a context.* Contextual constructivism recognises the significance of context in learning. Contextual constructivism is about understanding the fundamental, culturally based beliefs that both students and teachers bring to the classroom, and how these beliefs are supported by culture. According to Cobern (1993) contextual constructivism is nothing but the impact of culture on the teaching and learning of science. In contextual constructivism the student, the content, and the context are intimately connected. The student builds an understanding of content in context and the context mediates student understanding of content. Context shapes student learning and is in turn shaped by both content and the student.

Critical Constructivism

The roots of *critical constructivism* are said to lie in a series of articles which appeared in the journal *Critical Inquiry* (1991). It argue that besides 'truth' and 'reality', other research tools like 'evidence', 'document', 'experience', 'fact', 'proof', etc. are also important in a social and ideological construction, and these are also subject to criticism. It applies to many disciplines including natural science such as physics and biology, statistics, history, law, etc. According to Kincheloe (1993): "Critical constructivism concerns the attempt to move beyond the formal style of thinking which emerges from empiricism and rationalism, a form of cognition that solves problems framed by the dominant paradigm, the conventional way of seeing."

Watts and Jofili (1998) raise an interesting debate on 'constructivist teaching' claiming that the term is an oxymoron as it combines two contradictory actions: 'construction' and 'instruction' (teaching). They argue that "...constructivist teaching itself should be superseded in favour of 'critical constructivism', and approach which undertakes a broader critique of the relationships between teacher and taught, between learner and subject matter, and between schooling and society." According to them, "To be critical constructivists, teeachers must possess critical awareness: an understanding of themselves, their perspectives, their approaches to the construction of knowledge, and ways in which their own consciousness has been shaped by society (and schools)." They further observe that "Inside a critical constructivist classroom, learners reflect on the lives they lead, ask questions to discover meanings and values. Their learning experiences now include a self-

reflective dimension around themes from daily life. .....This aims to push them into becoming active participants in shaping the economic, social and cultural environment in which they live. These learners also become actively and critically involved in controlling their own learning, and teachers need to work towards the 'liberation' of learners, instead of their 'domestication'." They produce empirical evidence of teachers moving from constructivism towards critical constructivism in classroom transactions through in-service professional development course and action research.

In short, under critical constructivism the learner is expected to question the answers, the evidences, and the so called facts.

Cultural Constructivism

According to cultural constructivism, knowldege and reality, as perceived by a community of people, are dependent upon its culture, which may also dictate the methodology and approach. To give an example, for scientific studies, Western cultures use objects whereas Native American culture uses events. Superstitions and blind beliefs are also peculiar to cultures. Under cultural constructivism knowledge construction is perceived as a process of enculturation. Cultural constructivism appears to be a subset of the broader social constructivism.

Cybernetic Constructivism

Cybernetics is the study of self-organising systems. Cybernetic constructivism owes its origin to cybernetic developments in biology, neurophysiology, and cognition, in particular, cybernetics of self-organisation or second order– mode 2 - cybernetics (von Foerster 1984). It is based on the concept of autopoiesis (self-formation) originally developed to study cell biology. Autopoietic systems are self-contained and self-referential units. Besides biology the concept has been applied to physical, cognitive and psychic systems (Mingers 1995) and social, communication, and legal systems (Luhmann 1989, 1990, 1995). Cybernetic constructivism supports the basic notion of philosophical constructivism as a self-referential process of maintaining identity. Autopoiesis is said to manifest its constructivist character at the level of 'closure' of the nervous system in the sense that action and cognition depend on each other and not on any outside system. Von Foerster has argued that this happens when human brain interprets signals received from different sensory organs. Thus living beings are autopoietic systems. Accordingly,

Maturana and Varela (1980) have claimed that cognitive apparatus is an organisationally closed system. Riegler (2003) terms this *biological constructivism*. In this connection von Glasersfeld claims that "contemporary neurophysiological models may be compatible with a constructivist theory of knowing but can in no way be integrated with the notion of transduction of 'information' from the environment that any realist epistemology demands" (von Glasersfeld 1989).

Dialectical Constructivism

Dialectical constructivism is concerned with the interaction between a learner and her environment. It recognises that traditional views of cognition are not sufficient and both psychological and sociological factors are important for learning. The blending of psychology and sociology helps one to understand how individuals orient and learn from their surrounding and, further, how these interactive influences shape their mental processes. Dialectical constructivism is also called blended constructivism as it brings out the importance of the blending of psychology and sociology in the context of learning. It is linked to the joint efforts of psychologists and sociologists to understand learning from the perspective of 'contextualism' (Brunning,Schraw, and Ronning 1999).

Didactic Constructivism

Didactic constructivism is linked to the problem of operationalising radical constructivism in teaching (Brink 1991). Here the term 'didactic' has the connotation 'to realise'. The verb 'to realise' in turn has two components: 'to construct', and 'to confront'. In this process the learner constructs a conceptual representation and then confronts it with the ideas of the others. It enables one to discover mistakes which could not be perceived earlier. Similarity between this and the Socrates' 'dialogue' discussed earlier in the context of philosophical constructivism may be seen.

Human Constructivism

Human constructivism (Sharma 2006), due to J. D. Novak (Novak 1993), basically proposes that the process of meaningful learning, as understood through assimilation theory, is fundamental to both the psychological process of cognitive development of individuals and the epistemological process of new knowledge construction. It avers that learning and research are nothing but meaning making mechanisms. A researcher as well as a new learner constructs meaning out of a

new experience by connecting it to their existing knowledge framework. This means that a scientist and a learner use the same cognitive processes in the construction of new knowledge. The consequent conceptual change may occur in small incremental steps resulting in a 'weak' from of knowledge reconstruction or in a rapid and abrupt manner resulting in a 'strong form of knowledge reconstruction. This is valid for both a scientist and a learner. According to human constructivism, knowledge is an idiosyncratic, dynamic construction of human beings and in identical situations two human beings may construct two different meanings. This brings out the 'human' aspect of a scientist's work, which is often ignored in teaching-learning situations.

Information-Processing Constructivism

According to *information-processing constructivism* (Melnerney and Melnerney 2002) ability of an individual in information processing is crucial in the process of learning. It suggests that a learner has an independent capacity to self-actualise, i.e. the learner can actively organise his/her own learning experiences with clear ideas of means and ends.

Mathematical Constructivism

Mathematical constructivism (Riegler 2003) is a reaction to Platonism in mathematics. Its proponents, such as I.E.J. Brouwer, Arend Heyting, and Jean Paul van Bendegem claim that mathematical objects exist only if they can be constructed by a method. For this reason they oppose, for example, the notion of infinity.

Physical Constructivism

There exists a 'physical' approach to cognition (Riegler 2003). The proponent and physicist O. Diettrich (2001) argues that the perceived patterns and regularities are just invariants of inborn cognitive (sensory) operators. Different sets of cognitive operators generate different cognitive phenotypes. Laws of nature are, therefore, human specific. According to the physicist G. Grossing (2001) the perceived non-classical structure of space and time in relativistic class are human-specific artefacts based on neurophysiological processes.

Pragmatic Constructivism

According to Rieber (1993), *pragmatists* are those teachers and researchers who have developed a braod and general constructivist

perspective through their disposition, reading and professional development programmes, but have a narrower view of the same in classrooms.

Psychiatric/Therapeutic Constructivism

This constructivism is used as a family therapy to solve interpersonal problems (Watziawiek et al 1974). It aims at disrupting the pattern of symptomatic interpretation of a habitual situation by 'reframing' the situation. The procedure is to "place a conceptual and/or emotional setting or viewpoint in another frame which fits the 'facts' of the same concrete situation equally well or even better and thereby change its entire meaning". This way the patients are enabled to find alternative constructions of their world-view.

Socio-Historical Constructivism

This form of constructivism basically suggests that humans are social beings, situated within the culture and history of a society, which shape their thinking process.

Sociotransformative Constructivism

The sociotransformative constructivism (Rodriguez 1998) originated to help teachers in making their science and mathematics classes more gender-inclusive, socially relevant, and student-centred. It attempts to unite social constructivism as a theory of learning and multiculturalism as a theory of social justice.

Trivial Constructivism

This advocates the thesis that all knowledge is human construction (von Glasersfeld, 1993). It, however, has 'discovery of ontology' as its purpose (Osborne, 1996). It also means that the worldviews, which are differently constructed, gradually converge towards a knowledge system that represents the world objectively.

Weak Constructivism

Paul Ernest (1995) describes weak constructivism as one in which individuals construct their own knowledge (a local notion), while accepting the existence of objective knowledge (*a global notion*).

In Table 1 we give a summary of the main tenets of the different forms of constructivism discussed above. The table enables us to recognise the distinctions between them at a glance.

Less Familiar Pathways in Constructivism

<div align="center">**TABLE 1**</div>

Form of constructivism	Main tenets
Communal constructivism	Students and teachers as a community; Members help one another in knowledge acquisition; Each member creates knowledge for other; Use of ICT and networked learning
Computational constructivism	Cognitive development of learner; Neural dimension of cognition
Constructionism	Knowledge construction facilitated by construction of and experimentation with artifacts
Contexual constructivism	Significance of context in learning; Impact of culture on learning
Critical constructivism	Construction has a critical dimension; Construction has a self reflective dimension
Cultural constructivism	Knowledge and reality depend upon culture; Knowledge construction is a process of enculturation
Cybernetic constructivism	Concept of autopoiesis; Cognitive apparatus is an organisationally closed system
Dialectical constructivism	Interaction between learner and environment; Blending of psychological and sociological factors for learning; Contextualism
Didactic constructivism	Operationalising radical constructivism in teaching; Construction and confrontation; Discovering mistakes
Human constructivism	Knowledge as idiosyncratic and dynamic human construction; Learning and research use similar meaning making mechanisms; Weak and strong forms of knowledge reconstruction
Information-processing constructivism	Information-processing; Self-actualisation
Mathematical constructivism	Mathematical objects exist if they can be constructed by a method
Physical constructivism	Inborn cognitive operators; Cognitive phenotypes; Neurophysiological processes
Pragmatic constructivism	Broad constructivist perspective gained through reading, disposition and professional development but narrower view of constructivism in classrooms
Psychiatric/ Therapeutic constructivism	Solving interpersonal problems; Reframing a habitual situation; Alternative worldviews
Socio-historical constructivism	Humans as social beings situated within culture and history; Thinking process shaped by culture and history
Sociotransfor-mative Const.	Uniting social constructivism as a theory of learning and multiculturalism as a theory of social justice
Trivial constructivism	Knowledge is human construction; Discovery of ontology
Weak constructivism	Own knowledge as local notion; Objective knowledge as global notion

Conclusion

Recognising the fact that the five major varieties of constructivism namely *philosophical constructivism, sociological constructivism, Piagetian constructivism, radical constructivism,* and *social constructivism* (which belong to the three major constructivist traditions) are generally widely discussed and disseminated in the literature, in this paper we have tried to highlight some of the less prominent varieties of constructivism whose significance can be judged on their merit. It must be pointed out that these varieties are not less important; rather they attempt bring to the fore subtle but significant issues in constructivism. They are only limited in their domains of operation. They appear to be less global and more local in their scope. Some of them may be directly traced to the major varieties whereas some others appear to have an independent stance. They appear less widely in the literature. This is one reason why we have given here a brief account of only 19 of the list of 25 less known forms of constructivism cited above. However, it may not be far from truth if we conclude that these minor varieties constitute some 'fine structures' of the major varieties of constructivism. In view of their individual significance it may be important to bring the implications of these less known varieties of constructivism into teaching–learning situations.

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