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# *Of the Trivial and the Radical: Is There a Coherent Constructivist Pedagogy?*

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*Where a pedagogy is to be understood not simply in its weak sense as a range of classroom techniques but rather in its strong sense as embodying some conception of the ends of education such techniques subserve, coherence derives from the theoretical basis to which that pedagogy appeals. Where, however, such a theoretical basis is indistinguishable from that it purports to supplant or where it is inherently self-contradictory, the resulting pedagogy is incoherent. It is maintained here that "trivial constructivism" fails in the first respect and "radical constructivism" in the second and that any pedagogies based upon them are therefore incoherent.*

For some, a "constructivist pedagogy" variously constitutes a "major revolution" (Jonassen 1991a, p. 5), a "major paradigm shift" (Prawat 1992, p. 354), or "nothing less than a transformation" (Thayer-Bacon 2000, p. 36) in current teaching practice. The constructivist "revolution" is such since it purports to overthrow a "traditionalist pedagogy" in favour of one which places the learner at the center of the educational enterprise. As Catherine Twomey Fosnot puts it, constructivist teachers "need experience as learners that confront traditional views of teaching and learning in order to enable them to construct a pedagogy that stands in contrast to older, more traditionally held views." (1996, p. 206) By way of contrast with those older, more traditionally held views, the central feature of constructivist pedagogy is the activity of the learner in creating his/her own unique cognitive structures by means of which understanding takes place. While differences of emphasis in respect to the place of the individual as opposed to that of the social group have emerged within the framework of constructivist pedagogy, its unifying principle continues to be the individual act of construct creation. For example, Rebecca Oxford maintains that

> all versions of constructivism emphasized that learners construct meaning in an active way. This assertion challenged the value of fragmentary, passive learning. The potential integration of knowledge, particularly the linkage between the learner's existing knowledge and new knowledge was found throughout many versions of constructivism (1997, p. 45).[1]

[1] According to Oxford, the "many versions of constructivism" fall into two schools: "Loosely speaking, there are two general schools of constructivism: those considering the knower or knowledge constructor to be the individual (these are the individual/psychological constructivists), and those viewing the knower or knowledge constructor as the whole society or group or as the individual as firmly embedded in the group (the social/cultural constructivists). The individual/psychological constructivists seldom directly addressed issues of power, authority, and the place of formal knowledge that are central to some versions of social/cultural constructivism. On the other hand, social/constructivist perspectives were not uniformly well developed, and these perspectives

However, questions about the nature of that linkage between the learner's existing knowledge and new knowledge, questions of epistemology and ultimately of ontology, served to disrupt the unity of constructivist theory. The issue was not the uncontentious psychological claim that learners construct meaning in an active way by linking new knowledge to existing knowledge, usually framed in the context of the process of Piagetian assimilation and accommodation, but rather the highly contentious philosophical issue concerning the role, if any, of a knowable, independently existing reality in the construction of such meaning. It was Ernst von Glasersfeld's distinction between his own "radical constructivism" and what he called "trivial constructivism" which fragmented the theoretical foundations of constructivist pedagogy. According to von Glasersfeld (1989a):

> From my perspective, those who merely speak of the construction of knowledge but do not explicitly give up the notion that our conceptual constructions can or should in some way represent an independent, 'objective' reality, are still caught up in the traditional theory of knowledge that is defenceless against the skeptic's argument. From an epistemological point of view, therefore, their constructivism is trivial. (pp. 6-7)

The skeptic's argument, to which von Glasersfeld subscribes and which forms the basis of his "radical constructivism," consists of the claim that the knower can never demonstrate correspondence between his/her thought and an independently existing reality. This inability was not a contingent matter but one of principle. Where all knowledge is derived from experience, according to von Glasersfeld (1989b), "we have no way of checking the truth of our knowledge with the world presumed to be lying beyond our experiential interface, because to do this, we would need an access to such a world that does *not* involve our experiencing it." (p.2; italics in original) In the absence of any way of checking the truth of our knowledge with the world, those who spoke of the construction of knowledge yet who continued to assume that their conceptual constructions represented an independent, objective reality were condemned to triviality. As much of the writing on constructivist pedagogy concerns methodology rather than the epistemological assumptions supporting such methodology, it is, in von Glasersfeld's view, also necessarily trivial.[2] Because of the emphasis placed on the activity of construct creation rather than on the terms from which such activity derives its coherence, of portraying learning largely in terms of the learner's mental events or belief states rather than on that to which such events and states refer, the realist epistemology underlying trivial constructivism is often implicit rather than explicit.[3] Nevertheless, where a constructivist pedagogy maintains, whether explicitly or implicitly, that our conceptual constructions can or should in some way represent an independent, objective reality, it is indistinguishable from a pedagogy traditionally conceived and where it claims to supplant such a pedagogy, it is incoherent. In the case of radical

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sometimes paid little attention to individual knowledge construction" (p. 45). The perspective in the case of the present paper might be said to relate to a third school, that of individual/philosophical constructivism. For an overview of the various schools, see Paul Ernest, "The One and the Many," in Leslie P. Steffe and Jerry Gale (Eds.) (1995) *Constructivism in Education*, (Lawrence Erlbaum Associates, Hillsdale, N.J.).

[2] For example, see Bruce A. Marlowe & Marilyn L. Page (1998), *Creating and Sustaining the Constructivist Classroom*, Thousand Oaks, California. Corwin Press, Inc.; Terry Anderson (1996) "What in the World is Constructivism?", *Learning*, March/April: 49-51; Ann L. Brown (1994) "The Advancement of Learning," *Educational Researcher*. Vo. 23, No. 8: 4-12; Jacqueline Grennon Brooks (1990) "Teachers and Students: Constructivists Forging New Connections," *Educational Leadership*, February: 68–71.

[3] For example, see Andrew Davis's "Criterion-Referenced Assessment and the Development of Knowledge and Understanding," *Journal of Philosophy of Education*, 29.1: 3-22, whose "low-level constructivism," one which "does not make any radical claims about the non-existence of an independently existing reality," (p. 6) turns out to be not just not agnostic about that reality but firmly realist in its ontological assumptions. See my critique of Davis's "low-level constructivism" in "Outside/Inside: Criterion-Referenced Assessment and the Behaviourist/Constructivist Dilemma," *Paideusis: Journal of the Canadian Philosophy of Education Society,* 14/1, 2001: 5–14).

constructivism, where the link between those conceptual constructions and an independent yet knowable reality is explicitly severed, incoherence derives rather from the self-contradictory nature of its own principles. Where the only knowable reality consists of the individual's own conceptual constructions, radical constructivism, while purporting to abjure ontology, in fact advances its own and in the process, descends into a solipsistic relativism which undercuts any claim to primacy. A pedagogy based upon such self-contradictory principles is necessarily incoherent. The attempt to demonstrate such incoherence in the case of both trivial and radical constructivism will proceed on an inductive basis, interior to the claims of their respective proponents, and not one which presupposes any particular relationship between ontology, epistemology, and pedagogy.

Since it constitutes one of the more extensive articulations of its epistemological assumptions, Jacqueline Grennon and Martin G. Brooks' *In Search of Understanding: The Case for the Constructivist Classroom* (1993) provides a valid presentation of the case for trivial constructivism. The case for radical constructivism, of course, will be presented by its major proponent, Ernst von Glasersfeld. Unless otherwise indicated, reference will be to his major work, *Radical Constructivism: A Way of Knowing and Learning* (1995).

## Trivial Constructivism

According to the Brooks, "politicians and educators have been wringing their hands over the condition of education in our nation" (p. 3). The reason they have been wringing their hands concerns "reports that raise questions about the inability of American students to perform as well on content area tests as students from other nations." For a growing number of educators, however, among whom the Brooks number themselves, the primary concern is not performance on content area tests but rather "questions regarding understanding and meaning and the roles that schools play in encouraging or stifling the search for understanding (which) are far more important than questions regarding achievement as measured by test scores" (p. 3). For the Brooks, schools encourage the search for understanding when they conform to constructivist pedagogical principles and stifle it when they do not, when they fail, that is, to change from their traditionalist pedagogical practices to their constructivist counterparts. For the Brooks,

> traditionally, learning has been thought to be a 'mimetic' activity, a process that involves students repeating, or miming, newly presented information in reports or quizzes and tests. Constructivist teaching practices, on the other hand, help learners to internalize and reshape, or transform, new information. (p. 15)

Since nothing beyond simple assertion is given to support the claim that traditionalist pedagogy has been thought to be a "mimetic" activity, that it does not, like its constructivist counterpart, also encourage the search for understanding by helping learners to internalize, reshape, or transform new information, the central distinction between the two must reside in the manner in which constructivist practice succeeds in helping learners to engage in these activities while traditionalist practice falls short. To understand how this is so requires an understanding of the constructivist activities of internalizing, reshaping and transforming new information. In effect, it requires an understanding of the constructivist concept of understanding itself.

In claiming that "knowledge comes neither from the subject nor from the object, but from a unity of the two" (p. 5), the Brooks proclaim their trivialist credentials. A distinction is posited between the knower and the known, the latter in the form of "the object," of an independently existing reality amenable to rational inquiry which serves to constrain the unrestricted activity of the former. The occasion of the unity of the two or the act of coming to know, it is important to note, results in changes to the subject but not the object. The mind, for the Brooks, is constituted by a dynamic set of

cognitive structures that "grow in intellectual complexity as we interact with the world we come to know and as we gain experience." It is the construction of the subject's cognitive structures, not the transformation of the object, the world, which distinguishes the process of understanding from the trivialist perspective. However, the unity of the subject and object is not the outcome of an unruffled process since growth in intellectual complexity necessarily entails discrepancy which arises when "perception and 'reality' conflict" (p. 26). What happens when perception and (what is now) "reality" conflict marks the beginning of the constructivist journey into what Grennon and Brooks call "deep understanding."

Deep understanding is that which occurs "when the presence of new information prompts the emergence or enhancement of cognitive structures that enable us to rethink our prior ideas" (p. 15). This re-thinking of prior ideas is the central feature of constructivist epistemology—it is what the constructivist learner does when he constructs his own cognitive structures on the basis of what he already knows. But what is it about this "new information" that prompts the emergence or enhancement of those new cognitive structures that enables the learner to rethink his prior ideas? Where such new information necessarily *is* information by virtue of those cognitive structures by means of which it is organized, something more than its simple presentation is required in order for us to rethink our prior ideas. What new information, for example, would prompt the emergence of new cognitive structures that would enable the Brooks to rethink *their* prior ideas about the efficacy of constructivist pedagogy?

The difficulty in specifying what it is about that new information which would prompt the emergence of new cognitive structures resulting in the attainment of deep understanding lies in the idiosyncratic manner in which those structures are constructed. "Idiosyncratic constructions of prior experiences," according to the Brooks, "form the basis of the paradigms, the frameworks of thinking, we each use to perceive and consider the phenomena around us" (p. 24). As the constructivist journey into deep understanding progresses, that "unity of subject and object" becomes increasingly attenuated as that "idiosyncratic construction of prior experiences" waxes while the "world we come to know" wanes. But if the paradigms or frameworks of thinking we each use to consider the phenomena around us are idiosyncratic, having been formed by the idiosyncratic construction of prior experiences, the determination of which new information will prompt the emergence or enhancement of new cognitive structures that will enable us to rethink our prior ideas must also be idiosyncratic. All knowledge and its construction must therefore be idiosyncratic, including, presumably, the Brooks' own concept of deep understanding itself. The consequence is that one cannot assert the premise of deep understanding, that idiosyncratic constructions of prior experiences form the basis of the paradigms and frameworks we use to perceive and consider the phenomena around us, without self-contradiction. A further consequence is that the prospects for a coherent constructivist pedagogy which appeals to the concept of deep understanding as a theoretical foundation are not auspicious.

In spite of the fact that the idiosyncratic construction of experience as embodied in deep understanding precludes any general explanation of either how perception and reality *can* conflict or *how* new information prompts the emergence or enhancement of new cognitive structures which make us rethink our prior ideas, the Brooks proceed to compare the products of traditional teaching practices unfavourably with those brought about by the ministrations of constructivist pedagogy. The difference is to be found in the assessment of the behaviours peculiar to each.

> Unlike the repetition of prescribed behaviors, the act of transforming ideas into broader, more comprehensive images escapes concise description. We see neither the transformed concept nor the process of construction which preceded its transformation. The only discernible aspect is, once again, the student's behavior, but a different type of behavior. In the constructivist approach, we look not for what students can repeat, but for what they can generate, demonstrate, and exhibit. (p. 16)

It was, no doubt, the idiosyncratic nature of its construction that prevented a concise description of the act of transforming ideas into broader, more comprehensive images, of glimpsing the transformed concept or the process of construction that preceded its transformation. But if this is the case, why is the student's behaviour, made manifest in what he can generate, demonstrate, and exhibit, being the outcome of that act of transforming ideas into broader, more comprehensive images, not equally idiosyncratic? If idiosyncrasy precludes concise description of the process of image construction, why does it not also preclude concise description of its product? In any case, not to look for what the student can repeat in the form of prescribed behaviours but rather for what he can generate, demonstrate and exhibit *requires* a view of the process of construction that preceded the transformation of ideas into those broader, more comprehensive images. Otherwise, assessment can only be of that which the student can mimic, only what he can repeat in the form of prescribed behaviours. To distinguish between the different types of behaviour upon which the distinction between traditionalist and constructivist assessment rests, in other words, *demands* that which the model denies.

There is, of course, the more obvious objection that in traditional pedagogical assessment students also demonstrate, generate, and exhibit behaviours and that its portrayal as the measuring of "prescribed behaviours" that students can only repeat is little more than a constructivist caricature which equates traditional with behaviouristic pedagogy. Traditional pedagogical assessment presupposes the existence of an independent reality in respect to which the student displays varying degrees of mastery in the form of what he or she can generate, demonstrate, and exhibit and *depends* on seeing the transformed concept as well as the process of construction that preceded its transformation since it is only in such terms that any assessment can be made meaningful. In the absence of that reality in relation to which the changing degree of student mastery is to be determined, assessment is necessarily incoherent. Where that connection has been severed and where, as a consequence, its central feature becomes the idiosyncratic nature of student paradigms and constructs and the consequent inscrutability of the process of transformation of their prior ideas into broader, more comprehensive images, one can only ask what a constructivist assessment of what students can generate, demonstrate, and exhibit might look like.

The main consideration in constructivist assessment, according to the Brooks, is to "make assessment meaningful for students," (p. 122) a daunting task in view of the idiosyncratic nature of student paradigms. Constructing a set of "authentic" tasks won't do since, as they remind us, authenticity is also idiosyncratic.

> Authenticity is in the eye of the beholder and what is authentic to the adult task developer may not be especially authentic to many students. And what is authentic in one setting may not be authentic in another.

Faced with the idiosyncrasy of authenticity both in respect to the student and setting, all the constructivist "task developer" can do is to give up developing tasks and let each student generate, demonstrate, and exhibit those behaviours which are authentic for him/her self.

> If assessment measures learning and learning is idiosyncratic, then it is unlikely that one task, one portfolio, or one mode of exhibition could be appropriate for all students. Some students are still being denied the opportunity to demonstrate what they have learned in the most effective manner for them. (p. 123)

But if assessment measures learning and all learning is idiosyncratic, then there is no number of tasks, portfolios or modes of exhibition which could be appropriate for all students generally or for any student in particular. All are idiosyncratic and stand-alone items. Of course, since the teacher's own paradigms and cognitive structures are idiosyncratic as well, all assessment of those tasks, portfolios, and modes of exhibition must similarly be idiosyncratic. There can be no non-idiosyncratic standards in

any constructivist assessment except, self-contradictingly, the ascription of idiosyncrasy itself. It is not surprising that the Brooks ask, "Why do we give tests? Why do we give grades? Does doing such facilitate learning?" (p. 94). From a constructivist perspective the answer is clear. Where all learning is idiosyncratic and all assessment is in principle impossible, the questions presuppose precisely those standards of rationality which a constructivist pedagogy rejects.[4]

In contrast with its traditionalist counterpart, it was constructivist pedagogy which would encourage rather than stifle the search for understanding. While such understanding was initially conceived as a unity of subject and object, a trivial constructivist pedagogy was indistinguishable from its traditionalist counterpart and any claim to supplant it was therefore incoherent. However, where the quest for "deep understanding" was undertaken to resolve the discrepancy when perception and reality came into conflict, the exclusion of an independently existing reality in the epistemological equation rendered the construction of cognitive structures idiosyncratic and, consequently, a constructivist assessment of them incoherent. With trivial constructivism such an exclusion tended to be gradual, what might be called "the constructivist slide," resulting from the attempt to explicate such concepts as "deep understanding" and construct idiosyncrasy, all culminating in a ships-in-the-night assessment scenario. In the case of radical constructivism, however, the exclusion of that independently existing reality is immediate, systematic and one of principle.

## Radical Constructivism

"In the present vogue of constructivism," Ernst von Glasersfeld writes in respect to whether those recommending it have a clear idea of what it is,

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[4] The idiosyncratic nature of constructivist learning renders its assessment, according to David H. Jonassen (1991b) "perhaps the most difficult issue related to constructivism" (p. 28). Where "our personal world is created by the mind, so in the constructivist's view, no one world is any more real that any other," (p. 29) where providing criteria for referencing the evaluation of learning in advance "results in criterion-referenced instruction" (p. 29) and where "it is not enough to say that evaluation should be goal-free," (p. 29) Jonassen maintains, contrary to the Brooks' assessment of that different type of behaviour, it is the process of knowledge acquisition that should be evaluated, rather than its product. "Evaluating how learners go about constructing knowledge is more is more important, from a constructivist perspective, than the resulting product. This suggests that effective assessment should be integrated into instruction, that is, become part of the instructional process" (p. 30).

By way of showing just how effective constructivist assessment should be integrated into assessment, Jonassen observes that "as learners are acquiring knowledge, evaluation guidelines should be available" (p. 30). Jonassen reveals neither what these "guidelines" might look like nor how they are to be applied, but comes to the unavoidable conclusion respecting constructivist assessment. Where knowledge construction is the goal of constructivist evaluation and process is more important than product, "who better can evaluate knowledge construction than the constructor?" (p. 32). From a consistent constructivist perspective, one can only ask, who indeed?

By contrast, Robin Lee Harris Freedman's account of constructivist assessment, particularly as it relates to science, has a traditionalist quality:

> Students are actively engaged in learning in constructivist assessment environments because learning has personal relevance for them. This happens because the teacher knows what is relevant and uses local issues to draw students into the learning process. Issues emerge from student brainstorming that is guided by teacher 'savvy.' (1998, p. 5)

Tapio Puolimatka (1999) however, sees such constructivist guidance by teacher "savvy" more as manipulation.

> The fact that the progressive approach wants to avoid open authority forces it to resort to various forms of anonymous authority, because complex social settings tend to disintegrate without guidance. Anonymous power moulds individual consciousness subconsciously without providing the individual with rational means to assess or even be conscious of the moulding. (p. 298)

> this does not appear to be the case. Some of its advocates tout it as a panacea but would reject it if they became aware of its epistemological implications. At the other end of the scale, some of the critics jump to the conclusion that it denies reality, and therefore is a heresy they cannot fit into their orthodox metaphysical beliefs. (p. 175)

It was its rejection of those "orthodox metaphysical beliefs" together with their "epistemological implications" which distinguished radical constructivism both from its trivial counterpart and from those who jumped to the conclusion that it denied reality and was therefore a "heresy." Radical constructivism, according to von Glasersfeld, "refuses all metaphysical commitments and claims to be no more than one possible way of thinking about the only world we can come to know, the world we construct as living subjects" (p. 22). Radical constructivism for von Glasersfeld "is intended as a model of rational knowing, not as a metaphysics that attempts to describe a real world" (p. 24). The reason why radical constructivism does not attempt to describe a real world is that such a world cannot be known. "As a constructivist," von Glasersfeld (1989b) maintains, "I have never said (nor would I say) that there is no ontic world, but I keep saying that we cannot know it" (p. 3). This was where those critics went wrong and jumped to the conclusion that radical constructivism was a heresy. They thought that radical constructivism denied the existence of an "ontic world" when all it really did was to deny that we could know it. However, if metaphysical beliefs have epistemological implications, epistemological claims unavoidably imply metaphysical beliefs. The claim that we cannot know an ontic world but only the world we construct as living subjects not only implies but constitutes such a metaphysical belief, one which purports to describe the real world as it actually exists. How, then, does von Glasersfeld avoid the self-contradiction contained in his affirmation that the ontic world exists but we cannot know it on the one hand, while claiming to refuse all metaphysical commitments on the other? He attempts to do so by invoking what might be called "the constructivist disclaimer," the assertion that while radical constructivism may deny the possibility of knowing the ontic world, it is really no more than just "one possible way of thinking" about the only world we can come to know. "I would be contradicting one of the basic principles of my own theory," von Glasersfeld (1989c) points out,

> if I were to claim that the constructivist approach provides a true description of an objective state of affairs. As I see it, Radical Constructivism merely provides a different way of thinking and its value will depend mainly on its usefulness in our experiential world and only marginally on what professional philosophers have to say about it. (p. 2)

But if radical constructivism does not deny the existence of an ontic world but only that we can know it merely provides a "different way of thinking" and is not a metaphysical claim, are all other ways of thinking about the relationship between thought and that ontic world of equal value and use? The obvious question arises: What other ways *are* there to think about the relationship? To deny neither the existence of an ontic world nor the possibility of our knowledge of it is to be still caught up in that traditional theory of knowledge which radical constructivism purports to supplant. To deny the existence of an ontic world but not the possibility of our knowledge of it is patently incoherent. Radical constructivism seeks the third, pragmatic way. To speak of *any* relationship between an ontic world and our knowledge of it is to be defenceless against the skeptic's argument since there is no way of checking the truth of our knowledge with a world presumed to be lying beyond our experiential interface. It is to miss the point that there *are* no true descriptions of such an objective state of affairs and that the value of radical constructivism depends rather on its use in our experiential world, a use which the traditional theory of knowledge is seen to lack. How, then, will von Glasersfeld construct his "model of rational knowing" without reference to its truth, without reference to a metaphysics which attempts to describe a real world? Further, how will a coherent pedagogy derive its validity from the model so constructed?

These questions require, initially, a consideration of the "fundamental principles" of radical constructivism.

According to von Glasersfeld, the "fundamental principles" of radical constructivism may be stated in two propositions:

> 1. Knowledge is not passively received either through the senses or by way of communication. Knowledge is actively built up by the cognizing subject.
> 2. The function of cognition is adaptive, in the biological sense of the term, tending toward fit or viability. Cognition serves the subject's organization of the experiential world, not the discovery of an objective ontological reality. (p. 51)

Here, then, are those epistemological implications of radical constructivism of which the trivial constructivist was unaware and which would impel him to reject it rather than to tout it as a panacea. For the radical constructivist there *can* be no knowledge of an objective ontological reality gained either through the senses or by way of communication with others but only the possibility of his coming to know that which is viable for him, that which accords with his particular experience of it. But does this mean that the constructivist can construct anything he likes as long as it is viable for him, that each construct is solipsistically relative to the one who constructs it?

For von Glasersfeld, "Solipsism is a metaphysical statement about the nature of the world and leaves to others the task of explaining how the individual sets about to create its world … In practice, solipsism is refuted daily by the experience that the world is hardly ever what we would like it to be" (p. 113). Of course, if knowledge consists only of the organization of the subject's experiential world, a world which excludes the possibility of knowledge of an independently existing reality, then solipsism is necessarily a metaphysical and therefore meaningless statement since its attribution requires precisely that which radical constructivism rejects. In other words, there *can* be no charge of solipsism where knowledge is viewed exclusively as a construct of the subject's own experiential world since that is all there is. But if that is the case, how is solipsism refuted daily by the experience that the world is hardly ever what we would like it to be? Does not such experience imply a world not of the constructivist's own construction and in respect to which knowledge is consequently possible? By way of response, von Glasersfeld takes up the task that the metaphysical statement of solipsism leaves to others, that of explaining how the individual sets about to create its own world where, on the one hand, cognition can never discover an objective ontic reality but, on the other, it cannot construct just anything it likes.

Von Glasersfeld maintains that there are two "crucial principles" in respect to the constructivist not being able to construct anything he likes:

> The first is that cognitive organisms do not acquire knowledge just for the fun of it. They develop attitudes towards their experience because they like certain parts of it and dislike others. Consequently, human actions become goal-directed in that they tend to repeat likeable and to avoid the ones that are disliked. The way they attempt to achieve this is by assuming that there must be regularities or, to put it more ambitiously, that there must be some recognizable order in the experiential world. The second principle is that from the constructivist perspective, knowledge does not constitute a 'picture' of the world. It does not represent the world at all - it comprises action schemes, concepts, and thoughts, and it distinguishes the ones that are considered advantageous from those that are not. In other words, it pertains to the ways and means the cognizing subject has conceptually evolved in order to fit into the world as he or she experiences it. (pp. 113-114)

The first point to make in respect to the "crucial principles" which purport to establish that the constructivist knower cannot construct anything he likes is that the second principle merely constitutes a re-statement of the first from the perspective of the adaptive function of cognition as given in the second "fundamental principle." The claim that knowledge from the constructivist perspective does not

constitute a "picture" of the world but consists rather of action schemes, concepts, and thoughts distinguished on the basis of their being considered advantageous to the cognizing subject constitutes a generic reading of the first principle, that human actions become goal-directed on the basis of the fact that certain parts of the subject's experience are liked and others disliked. What is liked at the level of the subject is advantageous at the level of the species. Whatever the validity of this insight might be, it does bear a remarkable resemblance to a metaphysics, that "picture" of the world, which the "model of rational knowing" rejects.[5] The second point in respect to the "crucial principles" is that they do not show, independently of that picture of the world, just *why* the cognizing subject cannot construct anything he likes. What is to stop the cognitive organism which develops attitudes towards its experience on the basis of whether it likes certain parts of it and dislikes those others which purportedly distinguish advantageous schemes, concepts, and thoughts from those that are not, from constructing anything it likes as long as the organism likes it? What, apart from that ontic world, is to stop the constructivist knower from constructing anything he likes just for the fun of it?

Implicit in the assumption of some recognizable order in the cognizing subject's experiential world, on the one hand, and of that world into which he has devised advantageous ways and means to fit, on the other is, self-contradictingly, a metaphysical statement about the nature of the world. From the perspective of the cognizing subject, what is the ontological status of the self which develops those attitudes towards its own experience because it likes certain parts of it and dislikes others, the agent who constructs those action schemes, concepts, and thoughts which are distinguished on the basis of whether they are considered advantageous in contrast to those that are not? Does not such a self subsist as distinct from its experiential world, a world in respect to which it can adopt an attitude of liking or disliking and constitute thereby an aspect of that independent yet knowable reality which radical constructivism rejects as metaphysical? Indeed, is it not precisely *by virtue* of its ontic reality that the self both bestows coherence upon the activity of developing attitudes towards its own experience and, as resident in an independently existing reality, is constrained from constructing anything it likes? Alternatively, from the perspective of that world into which the conceptually evolved subject fits as he or she experiences it, what is the ontological status of that "recognizable order" which must be assumed in order for the cognitive organism to both generate those action schemes, concepts, and thoughts, and distinguish the ones which are considered advantageous from those that are not? If that order is indeed recognizable and not simply an artifact of the cognitive organism's activity of repeating likeable experiences while avoiding others, does it not similarly betoken the presence of that independent yet knowable reality which radical constructivism rejects as metaphysical?

If, however, that order *is* simply an artifact of the cognitive organism's activity, then why can it *not* construct anything it likes? The "crucial principles" raise a dilemma for radical constructivism: Either the self and its experiential world constitute aspects of an independent yet knowable reality with the result that the constructivist knower cannot construct anything he or she likes but the principles themselves are forfeit, or the self and its experiential world do not constitute aspects of an independent yet knowable reality with the result that the "crucial principles" are saved but the constructivist knower

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[5] The claim that knowledge from the constructivist perspective does not constitute a metaphysical "picture of the world" but consists rather of the subject's experience as embodied in action schemes, concepts and thoughts is open to the counterclaim that the perspective *itself* constitutes such a metaphysical "picture of the world." This has been noted before by D.C. Phillips (1996) who pointed out that von Glasersfeld

> wants to avoid metaphysics and insists that what we know - what we are in contact with - is our own individual experience. But this itself is a metaphysical position; there are many thinkers who claim that what we are in contact with are rocks, tables, chairs, other people and such. Putting a "veil of experience" between ourselves and these things is a metaphysical move like any other. (p. 20)

*can* construct anything he or she likes and radical constructivism collapses into an incoherent and self-refuting relativism.[6]

Initially at least, von Glasersfeld appears to concur in the existence of a self subsisting apart from any particular experience in respect to which it can adopt an attitude of liking or disliking.

> To my mind, it is precisely this awareness of what I am doing or expressing that is the foundation of what we ordinarily call our *self*. It does not have to be thinking in any elevated sense. If you are becoming aware of tying your shoe laces, you also become aware of the fact that there is a you who is doing it. (p. 122; italics in original)

But if the self cannot be reduced to the experiences in which it is engaged, if the "you" who is aware of the experience of tying your shoe laces is not to be understood as being an indistinguishable part of the experience of shoe-lace-tying but stands rather in the role of agent or observer of the activity, the self must subsist independently of any of its own particular experiences and thereby constitute to that extent an independent reality. Does von Glasersfeld's account of the self as the agent or observer of its own experience therefore save the "crucial principles"— the cognitive agent is aware of himself as constrained and cannot construct anything it likes just for the fun of it—but at the cost of conceding a realist conception of the self—that we are aware of ourselves as a reality existing independently of any particular experience? To avoid this consequence, what von Glasersfeld does is to change the question.

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[6] For von Glasersfeld (1995c) the order perceived in the act of recognition is self-generated:

> To recognize an item means to consider it the same as an item one has experienced at another time. Note that 'the same' is ambiguous. In this context it means either that the item in question is assigned to a category that has been formed earlier, or that one considers the item the self-same individual one has experienced before. The second meaning would be relevant when, for example, you say to your companion: 'Look behind us- that same man was following us when we left the airport.' This meaning may be labelled *individual identity*. Here I am not concerned with this, but only with the operations involved in the first of the two meanings. (p. 373; italics in original)

But the claim that to recognize an item is to consider it the same as one has experienced at another time is either to simply drive the question back to the ontological status of that item when it was initially experienced or, where one's recognizing something constitutes an aspect of one's prior experience, to maintain that one simply experiences one's own experience. In respect to initial concept formation, the opening of that "category" to which subsequent experiences of a similar sort will be assigned, radical constructivism is silent. In the case of experiencing one's own experience, W.A. Suchting (1992) sees von Glaserfeld's radical constructivism as "only following a completely traditional form of empiricism in speaking of the object of knowledge as being 'experience' (or something that adds up to the same thing)." (p. 230).

But, according to Suchting, "what is normally taken to be known is never 'experience'...The experience is a *means* to knowledge, not the *object* of knowledge." (pp. 230-231. Italics in original) In a similar vein, Michael R. Mathews (1992) claims that "Epistemologically, constructivism is the well-known old empiricist wolf in contemporary sheep's clothing; to change the metaphor, it is the empiricist wine, so criticized by constructivists, served up in new bottles." (p. 304) Mathews maintains that constructivism's rejection of Aristotelian empiricism in which the criterion of the adequacy of knowledge was correspondence between thought and object resulted in the relativizing of knowledge claims which could then only appeal to individual experience. However, according to Mathews, in science it is not the simple object as immediately given to experience nor one's experience itself which is the object of knowledge. Rather,

> once the real/theoretical object distinction is made, and knowledge is recognized as a process of intellectual production working with real objects that have been described, apprehended, or incorporated by a theoretical object, then the interesting epistemological tasks of evaluating different modes of knowledge production - in terms of fecundity, simplicity, utility - can be commenced. Relativism short- circuits all of this. (p. 309)

> Instead of asking what the self is in the philosopher's sense, one can ask how we experience our self. This does not concern the mysterious entity that does the experiencing, but focuses on the tangible structure of the body that is experienced as one's own. Such an investigation takes the mysterious self-conscious entity for granted and proceeds to examine how that entity comes to recognize itself both as agent and as percept distinguished from the rest of its experiential field. (p. 123)

But to ask how we experience our self, how that entity comes to recognize itself both as agent and as percept distinguished from the rest of its experiential field, *is* to ask what the self is in the philosopher's sense. To focus on the tangible structure of the body that is experienced as one's own does not banish the mysterious entity that does the experiencing but merely re-directs attention away from it. Although one might focus on the tangible structure of one's body in the act of tying one's shoe laces— one's fingers and their movements as they tie the laces, the position of one's foot, and so on—this does not banish the simultaneous awareness that there is a self who is doing it. Moreover, the self who is doing it is distinct from its experiential world of shoe-lace-tying and resides in that independent yet knowable reality which decrees that one cannot construct anything one likes, say putting on laceless rubber boots instead of actually tying one's shoe laces, a self which refuses to go away even if taken for granted. But if we do take von Glasersfeld's advice and stop asking what the self is in the philosopher's sense and ask rather about the tangible structure of the body that is experienced as one's own while taking that mysterious self-conscious entity for granted, in what way will a constructivist examination of the manner in which that entity comes to recognize itself as both agent and percept proceed? It proceeds, according to von Glasersfeld, by means of a constructivist *tour de force* in which the self as agent constructs others in the course of communication with them and the others, so constructed, proceed to construct the self as percept.

> If it is others from whose reactions I derive some indication as to the properties I can ascribe to myself, and if my knowledge of these others is the result of my own construction, there is an inherent circularity in that procedure. In my view this is not a vicious circle, because we are not free to construct others in any way we like. As with all other constructs, the 'models' we build up of others either turn out to be viable in our experience, or they do not and have to be discarded. (p. 127)

Like all constructivist knowledge, the knowledge of the self is actively built up by the cognizing subject. The cognizing subject, the self as agent, constructs "models" of others whose reactions, equally the constructions of the cognizing subject, then come to constitute the self as percept. The only reason that the constructivist knower cannot construct others and their reactions in any way he likes and thereby construct any self he likes is that such constructions or models must be viable in his experience, otherwise they must be discarded. The claim that we are not free to construct others in any way we like, of course, echoes the first "crucial principle," that we do not acquire knowledge just for the fun of it since we develop attitudes towards our experience because we like certain parts of it and dislike others. But if this is the only basis for the "models" we construct of others, then von Glasersfeld's investigation into the process of how the mysterious self-conscious entity comes to recognize itself both as agent and percept distinguished from the rest of its experiential field *is* viciously circular. Where the constructed models of others are identical with their reactions which constitute the self of the constructivist knower, the constructivist self *is* solipsistically self-constructed, embodied in the image he sees reflected in the mirror of his own construction. There is no reason to suppose that the constructivist cannot construct others, and therefore his self, in any way he likes.[7]

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[7] For von Glasersfeld (1989c), the construction of others in the course of social interaction "raises a problem for constructivists."

> If what a cognizing subject knows cannot be anything but what that subject has constructed, it is clear that, from the constructivist perspective, the *others* with whom the subject may interact socially cannot be posited as an ontological given.(p. 126; italics in original)

According to von Glasersfeld, the problem facing constructivists consists of the claim that since others with whom the subject interacts socially cannot be posited as ontological givens as the cognizing subject cannot know anything but what she has constructed, those others must similarly be constructs of the cognizing subject with the result that in social interaction the subject can never know those others but only her own constructs of them. From the constructivist perspective, the others in social interaction can only come to assume the form of diaphanous projections of the subject. By changing the wording from "constructing" to "imputing" however, von Glasersfeld hopes to solve the problem of others in constructivist social interaction by positing them as ontological givens while pretending not to do so.

> Here again, in order to develop relatively reliable schemes, the child must impute certain capabilities to the objects of interaction. But now these ascriptions comprise not only perceptual but also cognitive capabilities, and soon these formidable 'others' will be seen as intending, making plans, and being very and not at all predictable in some respects. (p. 130)

The capabilities imputed to others by the child in order to develop relatively reliable schemes come to assume a life of their own as they become embodied in formidable others seen as intending, making plans and even, remarkably in view of the fact that they all were the outcomes of the child's own constructions, becoming unpredictable. Once so reified, however, and perhaps even more remarkably, those formidable others then come to serve as "corroborators" of the subject's constructions.

> If we impute planning and foresight to others, this means that we also impute to them some of the schemes that have worked well for our-selves. Then, if a particular prediction we have made concerning an action or reaction turns out to be corroborated by what the other does, this adds a second level of viability to our scheme; and this second level of viability strengthens the experiential reality we have constructed. (pp. 130-131)

Such "corroboration" plays a significant role in von Glasersfeld's constructivist scheme, strengthening as it does the viability of one's constructs. Of course, since such corroboration has been the outcome of the construction by the subject of the other in the first place, it is difficult to see how his predictions concerning an action or reaction, or anything else for that matter, would *not* be corroborated!

For the "social constructivists" von Glasersfeld's "problem" of the subject's construction of others turned the question on its head. Rather than the subject constructing others and then himself as seen reflected in their gaze, it was the subject who was constructed through the social medium of shared language. Where all meaning is linguistic and all language shared social communication, all meaning is thereby socially constructed. According to the Deweyan James Garrison (1995), for example,

> the core of Dewey's behavioral theory of meaning and perhaps the core of his entire philosophy, is his argument for the natural origin of language in *shared* behavior... For Deweyans, the mind that manipulates meaning emerges socially through participation in the social process of meaning construction. (p. 722)

Garrison rejects the notion of individual concept construction as a "functionalist mentalistic" in which "structures like schemata and scripts are made out of a different kind of 'stuff' than the physical world to which they are applied" (p. 734). He does so because it constitutes "a static picture of abstract and decontextualized learning and knowing" (p. 734). While Garrison's observations themselves might well be seen as abstract and decontextualized, the burden of his claim is that the view is "undemocratic and unfit for persons and cultures that seek not only to persist but to progress" (p. 734). However, the difficulties discovered in von Glasersfeld's "problem" of the subject's construction of others have their epistemological echo for social constructivists like Garrison. How *can* competing truth claims arise in those communities in which meaning emerges socially through participation in the shared process of meaning construction? On what grounds is the "functionalist mentalistic" to be trumped by Garrison's "natural origin of language in shared behaviour?" Just how will the "functionalist mentalistic" be determined to be "undemocratic and unfit for persons and cultures that seek not only to persist but to progress?" According to Garrison, momentarily letting slip his mask of democratic sharing, the "functionalist mentalistic" has been trumped on the grounds that "the epistemological authority warranting a knowledge claim to be 'true' resides within the sociolinguistic practices of the community of those competent to judge" (p. 723). The view that construct construction was individual rather than shared was found to be undemocratic and unfit because it fell foul of Garrison's sociolinguistic practices and those who supported it, like von Glasersfeld, were consequently

Where the function of cognition, under the second "fundamental principle" and echoed in the second "crucial principle," tends towards fit or viability, where knowledge pertains to the ways and means the constructivist cognizing subject has conceptually evolved in order to fit into the world as he experiences it and where the "models" he build up of others either turn out to be viable in his experience or they do not and have to be discarded, egress from vicious circularity and the ability of the cognizing subject to construct anything he likes can lie only in the determination as to why some models are not viable and have to be discarded. Those models which are not viable and must be discarded, according to von Glasersfeld, perhaps unsurprisingly, are those which lack "fit."

> Unlike the notion of truth which would require a match, i.e., shared points and features of the picture and what it is intended to represent, the notion of viability (which refers to actions and ways of thinking) merely requires fit. This is a relation characterized by the absence of shared points, because they would be points of friction or collision. (p. 117)

Fit is achieved when the organism meets no resistance, when it can nose its way along a conceptual crawlspace without encountering friction or collision. Unlike the case with the traditional model, however, the cognitive organism can make no claim to a knowledge of the contours of the terrain or indeed of the crawlspace itself but only whether its questing has encountered obstruction. Where such obstruction does occur, the questing organism, disliking such experience, discards it and proceeds to seek a viable alternative, one in which no friction or collision is experienced. Fit is then achieved and the organism then develops attitudes of liking which it will tend to repeat. This repetition of experience made viable by fit is the basis of that recognizable order in the constructivist's experiential world.

Of course, von Glasersfeld's rat-in-the-maze model of the cognitive organism's construction of its experiential world is not itself intended to be understood as the outcome of viability, of his cognitive schemes merely having encountered no friction or collision and hence having achieved fit but rather it is to be understood as that "notion of truth," one purporting to possess a match between those shared points and features of radical constructivism, on the one hand, and what it is intended to represent, the true nature of ontic reality, on the other. The notion of viability and fit, in effect, constitutes an articulation of that which the principles of radical constructivism reject. However, while viability and fit may betoken the presence of an ontic reality and the cognitive organism as a consequence cannot construct anything it likes just for the fun of it, that ontic reality is present only in a negative sense, in the form of constraint.

Unlike the case with the traditional model, the notion of viability holds that the subject can only know it either in terms of points of obstruction or of fit. According to von Glasersfeld,

> It is certainly not the case that 'anything goes.' It is always possible that an ontic reality manifests itself by impeding some of our actions and by thwarting some of our efforts. But even if this should be the case, this ontic reality would manifest itself only in failures of our acting and/or thinking, and we would have no way of describing it except in terms of the actions and thoughts that turned out to be unsuccessful. (p. 118)

While von Glasersfeld's account of the nature of the interaction between thought and reality, once again, is not itself to be understood as the outcome of his own failures in acting and/or thinking but rather as an outcome of his successes, of accurately constructing that "notion of truth" in which the interaction is properly depicted, what is to distinguish his knowledge of an obstructionist or viable reality from its traditionalist counterpart? What, for example, is to distinguish his explanation of my

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not competent to judge. They did not share Garrison's linguistic behaviour where the natural origin of language is to be found nor share his social process of meaning construction. They did not belong to Garrison's community where the epistemological authority warranting a knowledge claim to be "true" resides.

failure to jump ten feet high in terms of an ontic reality that thwarts my effort to do so as opposed to an explanation given in terms of the laws of gravity beyond the fact that the former is explicable in terms of the latter as it possesses not just greater explanatory force but, for the present purpose, embodies a positive knowledge of that ontic reality? The admission of an ontic reality, even where known only through its negative manifestations, in effect, refutes the central claim of radical constructivism. The subject's organization of his experiential world depends, therefore, on the discovery of such an independently existing reality and his action schemes, concepts, and thoughts derive their coherence from that "picture" of the world which such knowledge embodies. It is for this reason, after all, that not anything goes, that the cognitive organism can not construct anything it likes just for the fun of it.[8]

## A Coherent Constructivist Pedagogy?

Oddly, in view of the solipsistic individualism underpinning the epistemology of radical constructivism, the pedagogical end-state envisioned as a consequence of its application is not the unfettered construction of those cognitive schemes constituting the student's experiential world but rather it comes to embody a conservative, even a reactionary "accepted adult way(s) of acting or responding to certain experiential situations" (von Glasersfeld, p. 159). But if, in the pedagogical encounter between teacher and student in which each is a construction of the other and where each constructs himself in terms of the reactions of the other so constructed (or, alternatively, where the student and teacher are each conceived in terms of a negative ontic reality which manifests itself in the form of obstruction, of impeding or thwarting each other's efforts at viability and fit!), how is the constructivist teacher to proceed? Where an independent yet knowable reality in the form of a knowledge of other minds, here the teacher's knowledge of the student's comprehension of a distinctive subject matter, is in principle ruled out, how does the constructivist teacher bring the student to those accepted adult way(s) of acting or responding to certain experiential situations and know that he has done so?

"The fundamental principle from which most of my suggestions for the practice of teaching derive," von Glasersfeld points out,

> is that concepts and conceptual relations are mental structures that cannot be passed on from one mind to another. Concepts have to be built up individually by each learner, yet teachers have the task of orienting the students' constructive process. (p. 186)

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[8] A realist epistemology may be seen to underlie the constructivist view that the world can be known only through the constraints placed upon the knower in terms of the viability and fit of her conceptual structures. For example, Gregory J. Kelly (1997) maintains that

> the lock and key model of viability of knowledge claims can easily be interpreted as a form of realism - an ontological position radical constructivists often seek to discredit. By suggesting that the key must fit, radical constructivists suggest that the lock is not constituted by the key. They seem to want to admit that theories face resistances, breakdowns, or perturbations - are restrained by something other than cognition - and at the same time that the process of understanding constitutes the world. If the world is malleable to our prejudices, why do we face perturbations? (p. 362)

In the same vein, William Cobern (1990) points out that

> the value of radically constructed knowledge is in its *viability*. One does not worry that knowledge match reality, only that knowledge allow the useful prediction of experience, its impact. When it does so predict, what metaphysics does viability reinforce?...I am inclined to think that viability reinforces the estimation that knowledge is approaching reality, and in fact undermines constructivism. (p. 7)

Where concepts and conceptual relations are mental structures which cannot be passed from one mind to another but must be built up individually by each learner, the question becomes not so much how the constructivist teacher goes about orienting his students' constructive process but rather the possibility of his doing so at all. To orient the students' constructive process requires both knowing what those initial mental structures might be, knowing that independently existing reality embodied in the accepted adult way of acting or responding to certain existential situations, and the ability to direct the former to conform to the latter. However, if such structures are constituted by those unique and unknowable conceptual schemes by means of which their owners' experiential worlds are organized and if they cannot be passed from one mind to another, how can the teacher's task of orienting the students' constructive process proceed?

The teacher's task of orienting the students' constructive process proceeds, according to von Glasersfeld, by the "judicious use of language.

> The teacher cannot tell the students what concepts to construct or how to construct them but by a judicious use of language they can be prevented from constructing in directions which the teacher considers futile but which, as he knows from experience, are likely to be tried. (p. 184)

Under the principles of radical constructivism, whether "fundamental" or "crucial," where, that is, he can possess no positive knowledge of an independently existing reality, where he neither can know the conceptual schemes of his students nor pass along concepts and conceptual relations from one mind to another by means of language, the teacher becomes in effect a pedagogical night watchman, standing guard against those futile errors in construction which he committed in the past and knew from experience were likely to be tried again. He can never tell the students which of his conceptual schemes achieved viability and fit, these being unique and incommunicable but, by the judicious use of language, he can reveal those schemes which encountered friction or collision with that ontic reality he knew only negatively as obstruction. But, where it is given under the "fundamental principles" that no knowledge can be transmitted by way of communication, where it is given that mental structures cannot be passed from one mind to another, just how can the night watchman discharge even *these* minimal cautionary duties? What would his judicious use of language look like?

Unfortunately, von Glasersfeld never reveals just how the constructivist teacher, by that judicious use of language, orients the students' constructive process so that they avoid taking those directions he knows to be futile. While his account of the prophylactic function of language in the classroom is, once more, to be understood in terms of that "notion of truth," of corresponding to the way things actually are (or should be) rather than having emerged as the outcome of viability and fit, it does not augur well for a coherent account of assessment. Where he can only know his own cognitive structures, how will von Glasersfeld's constructivist teacher be able to assess the degree to which he has oriented those of his students so that they come to embody the accepted adult way of acting or responding to certain experiential situations?[9]

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[9] D.C. Phillips (1995) appears to be at odds with the view that constructivist pedagogy is tacitly deeply traditionalist or even reactionary when he states that while the epistemology of radical constructivism is "weak or at least controversial," it has lead to a "strong pedagogic policy." He writes:

> Moreover, it is clear from von Glasersfeld's perspective that everyone studying a field like science has his or her own set of conceptions and preconceptions that influence the course of subsequent learning; teachers should drop the fashionable but misleading talk of student 'misconceptions,' for this implies that there is a standard set of 'correct' conceptions that all learners have. One result of all this is to highlight the need for individual attention to students and the need to give guidance about how bodies of understanding are built up. *It could be argued here that a weak or at least a controversial epistemology has become the basis for a strong pedagogic policy.* (pp.10–11; italics in original)

According to von Glasersfeld, "The teacher's assessment of a student's conceptual structures does not have to be a blind conjecture. If one starts from the assumption that students generally try to make sense of experience, it is usually possible to get some idea of how they think" (p. 187). But is not getting some idea of how students think in violation of the "fundamental principles" as it assumes at least some correspondence between one's own cognitive structures and an aspect of an independently existing reality as embodied in the general nature of students and their tendency to try to make sense of experience? Alternatively, where it is based upon communication between a teacher and his students, is not the assumption that he can usually get some idea of how they think merely an endorsement or corroboration of his own construction of them? If a constructivist assessment is *not* to be a blind conjecture, in other words, von Glasersfeld must reveal how it is done without reference to an independent but knowable reality, here in the form of other minds.

For von Glasersfeld (1989a) the knowledge of other minds and by extension any assessment of them, is "*terra incognita."* In contrast to behaviourism, he points out that where the object of education

> is to lead the children or students to some form of *understanding*, the teacher must have some notion of how they think. That is to say, teachers must try to infer, from what they can observe, what the students' concepts are and how they operate with them. Only on the basis of some such hypothesis can teachers devise ways and means to orient, direct or modify their students' mental operating. This is a context in which the constructivist approach and its analysis of conceptual development seemed promising. In spite of Piaget's seminal work, that area is still to a large extent *terra incognita*.(pp. 16–17; italics in original)

As with his judicious use of language and its power to orient the students' constructive process so that they avoid taking directions he knows to be futile, it is never revealed how von Glasersfeld's constructivist teacher *can* have some notion of how his students think. Where each constructs the other and the constructions so constructed come to constitute the self, it is not clear *how* the teacher can infer from what he observes just what the students' concepts might be, how they operate with them and how, as a consequence, the teacher *can* assess them. Given the principles of radical constructivism, the area of conceptual development and its assessment must itself remain a *terra incognita.*

For von Glasersfeld, (1989c) constructivism carries with it "rather profound changes in the practice of education." (p. 135) However, in view of the preceding analysis of both its trivial and radical manifestations, it is difficult to see what those changes might be. With trivial constructivism, where it was maintained that our conceptual constructions can or should represent an independent, objective reality, incoherence derived from the claim to supplant a traditionalist pedagogy from which it is indistinguishable. In the case of radical constructivism, where it was maintained that those conceptual constructions do not represent an independent objective reality, incoherence derived from the self-contradictory nature of its principles and consequently bestowing a comparable incoherence of a

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However, Phillips (1992) earlier maintained, in respect to science education, that there *is* a standard of "correct" conceptions that all learners must have and so, it appears, it is *not* misleading to talk of student "misconceptions." He writes that

> It is extremely odd that science education, in particular, has provided a supportive home for radical constructivism. For it would seem that, whatever views of science are held by science educators (and several different views are possible), such views ought to be true to the practice of the vast majority of the scientific community. The point is that it seriously can be doubted whether many scientists act in a manner which is in accord with the relativistic or subjectivistic views of radical constructivism! For – speaking epistemologically rather than psychologically - if scientific knowledge is the personal and subjective construction of each individual, then the need for scientific inquiry disappears - scientists would be put out of business. (p. 314)

Speaking epistemologically rather than psychologically, it might also be claimed that if the principles of radical constructivism were to be applied consistently the result would be not so much a weak but rather an incoherent "pedagogic policy" and it would not be the scientists but the teachers who would be put out of business.

pedagogy based upon them. As a result, von Glasersfeld's (1995b) claims about the impact of constructivism on education are only partially valid. "Constructivism," he maintains,

> does not claim to have made earth-shaking inventions in the area of education; it merely claims to provide a solid conceptual basis for some of the things that, until now, inspired teachers had to do without theoretical foundation. (p. 15)

Notwithstanding the prior claim that constructivism carries with it "rather profound changes in the practice of education," von Glasersfeld's re-considered version that it has made no earth-shaking inventions in the area of education seems closer to the mark. This is so for the same reason that it does not provide that solid conceptual basis for some of the things that inspired teachers have heretofore had to do without theoretical foundation. It does not do so because, as has been seen, constructivist pedagogy is theoretically incoherent and therefore, where it claims to differ from traditional pedagogy, practically vacuous.

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