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PHILOSOPHICAL PROBLEMS WITH CONSTRUCTIVISM

Some considerations for student-centered learning and teaching

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Introduction

Constructivism as a theory of knowledge and learning has been the major influence in contemporary science and mathematics education; and in its post-modernist and deconstructionist form, it is a significant influence in literary, artistic, social studies, and religious education. Its impact is evident in theoretical debates, curriculum writing, and pedagogical practice in all of these subjects. Constructivism as a psychological, educational and philosophical orientation fuels the student-centered, teacher-as-facilitator, localist, “progressive” side of the educational math wars, phonics debates, and discovery learning disputes. It is the default theory in “student-centered” education programs and courses. As stated by one group of researchers:

From a constructivist perspective, the individual learner has a primary role in determining what will be learned. Emphasis is placed on providing students with opportunities to develop skills and knowledge which they can connect with prior knowledge and future utility. . . . The learner decides with others what learning is important to him or her and means of learning are explored. While working with others, the student solves problems and examines solutions. This view of curriculum is closer to the actual work of scientists.

(Davis et al. 1993, p. 629)

An editorial in the Journal of Teacher Education declared:

Constructivism is the new rallying theme in education. Its popularity derives from its origins in a variety of disciplines, notably philosophy of science, psychology, and sociology. The implications of a constructivist perspective for education differ depending on its disciplinary foundation, but professional education groups as diverse as the National Association for the Education of Young Children and the National Council of Teachers of Mathematics have based revisions of their standards for practice on the
constructivist assumption that learners do not passively absorb knowledge but rather
construct it from their experiences.

(Ashton 1992, p. 322)

Fifteen years later:

Hence, the current teaching standards in the USA call for teachers to embrace a social
constructivist view of learning and teaching in which science is described as a way
of knowing about natural phenomena and science teaching as facilitation of student
learning through science inquiry. . . . In particular, the reform emphasizes teacher edu-
cation by promoting social constructivist teaching approaches. . . . These sophisticated
epistemological perspectives are promoted in the US science education reform docu-
ments as both learning goals and teaching approaches.

(Kang 2008, pp. 478, 480)

Constructivism received administrative-industrial endorsement when in 2015 the state of Mis-
souri introduced a teacher pay-scale where pay increases are tied to teachers adopting construc-
tivist classroom methods, independently of student learning outcomes (Krahenbuhl 2016). No
matter how little students learn, or how many fail, teachers are financially rewarded provided
they toe the agreed line. This is another of the many triumphs of ideology over good sense in
education.

The remainder of this chapter will indicate the twofold intellectual origins of constructivism
within the Kuhnian revolution in philosophy of science and within Piagetian learning theory; it
will spell out faulty epistemological and ontological commitments flowing from those sources;
it will lay out some unfortunate and unforeseen cultural consequences of constructivism and
finally suggest some lessons that this whole historical process has for proponents of student-
centered pedagogy.

Origins of educational constructivism

Educational constructivism, more specifically as it took form in science education, grew out
of the mushrooming studies of children’s thinking about nature – their “proto-scientific”
concepts – that began in the 1970s and 1980s (Driver, Guesne & Tiberghien 1985). This “chil-
dren’s science” research focused on acquisition of concepts and conceptual change; it rejected
behaviorist-sanctioned classroom rote learning as not worth learning by students nor worth
researching by academics. The conviction was that learning was not just a matter of present-
ing new information or concepts to a student, but the new material had to be meaningful, and
consequently it had to cohere with or be interpreted by extant concepts and ideas. Yes, students
do learn from experience, but experience is not just the result of sensation (visual or auditory);
experience comes from a combination of sensation plus extant “knowledge” or conceptions. As
Norwood Russell Hanson, repeating Plato, memorably wrote: “There is more to seeing than
meets the eyeball” (Hanson 1958, p. 5).

Typical research questions were: How do children conceptualise and understand the natural
world (objects, events and processes) before they enter science classes? How does this “native”
understanding and conceptualization change in response to instruction? Are there identifiable
barriers to scientific understanding? Are there cultural differences in children’s science? How do
students construct knowledge when they work in groups? How do students negotiate mean-
ing? And, what is involved in forming consensus? This research tradition was largely empirical,
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descriptive or phenomenological. The most recent version of the authoritative “constructivism and research” bibliography prepared by Reinders Duit and colleagues at the University of Kiel is available online and contains 8,400 entries (Duit 2009).

The tradition largely ignored the distinction, made since Plato, between belief or opinion and knowledge; the terms were synonymous in children’s science research. It was routine to see studies of change of beliefs given the title of “knowledge development.” The question of whether the new beliefs constituted knowledge did not arise. Indeed, the question is little attended to in educational research on children’s learning. The closest to it appearing is the oft-repeated claim that “knowledge is whatever can be retrieved from long-term memory.” The view is that if it is not in long-term memory it is not knowledge; and conversely if it is in long term memory, then it is knowledge. To a philosopher, and to many others, such a claim is manifestly silly: all sorts of nonsense and discredited beliefs can be retrieved from long-term memory. Some folk can retrieve all of Mao’s thoughts, all of the Old and New Testaments, all of the Qur’an or all of the Book of Mormon from long-term memory. Clearly such retrieval, by itself, does not make the constellation of remembered assertions into knowledge; that is a separate epistemological question.

The “children’s science” tradition was reviewed at the time (Driver & Erickson 1983; Gilbert & Watts 1983), and it was widely recognized that theory played a very minor role in the tsunami of new studies. Roger Osborne and Merlin Wittrock wrote: “Most of the research on children’s ideas in science has not then been theory driven” (Osborne & Wittrock 1985, p. 60). Michael Shayer observed: “The whole field of ‘alternative conceptions’ is that of vast empirical data, crying out for an interpretative model” (Shayer 1993, p. 816). Joseph Novak comments in one place that he had read 400 education research papers, of which about 20 were theory-informed.

This is a major admission: if some practice is persistently not informed by theory, then it simply is not science. Lots of practices and hobbies involve observing, counting, measuring, cataloguing, but if this is done removed from any theoretical commitment or testing, then it is just a human activity. Stamp collecting and bird watching are engaging and skillful activities, but they are not science unless they are linked to hypotheses or theories that connect with extant science.

The Children’s Science research program was buttressed by David Ausubel’s The Psychology of Meaningful Verbal Learning (Ausubel 1963, 1968; Ausubel et al. 1978). Ausubel’s foundational premise – “The most important single factor influencing learning is what the learner already knows. Ascertain this and teach him accordingly” (Ausubel 1968, p. vi) – became the rallying cry of the program. Because history and philosophy of education are removed from education programs, that Ausubel’s basic dictum was enunciated 2,500 years earlier by Socrates, was seldom recognized. All the Socratic Dialogues begin with an interrogation: “What do you understand by X?”

Joseph Novak, a co-author of the second edition of Ausubel’s book, wrote in criticism of Piagetian research, and its mistakenly associated discovery-learning pedagogy, that:

While discovery learning strategies have some important and unique educational values, it is obvious that our cultural heritage, created by geniuses over the past three or four centuries, cannot be rediscovered by our pupils in 10 or 15 years. It follows, therefore, that the central task of schools is to make expository teaching and reception learning meaningful, and I will argue in this paper that Ausubel’s theory of cognitive learning is more relevant more powerful for science and mathematics education than the psychology of Jean Piaget.

(Novak 1977b, pp. 453–454)
Another popular theory of conceptual change (or learning) was advanced by George Posner and colleagues: “Accommodation of a Scientific Conception: Toward a Theory of Conceptual Change” (Posner et al. 1982). They proposed that, for individual conceptual change or learning to take place, four conditions had to be met:

1. There must be dissatisfaction with current conceptions.
2. The proposed replacement conception must be intelligible.
3. The new conception must be initially plausible.
4. The new conception must offer solutions to old problems and to novel ones; it must suggest the possibility of a fruitful research program.

Ten years after its publication two of the co-authors were moved to publish “A Revisionist Theory of Conceptual Change” (Strike & Posner 1992), in which they pointed out that the original paper was intended to be an account of rational conceptual change; it was not a psychological theory of conceptual change, much less a pedagogical template for classroom teaching:

This theory is largely an epistemological theory, not a psychological theory. It follows that it is also a normative theory. It is rooted in a conception of the kinds of things that count as good reasons.

(Strike & Posner 1992, p. 150)

Kenneth Strike had been explicit about this in a parallel paper published at the time as the much-cited Posner et al. (1982) paper. He defends the view that the task of learning is primarily one of relating what one has encountered to one’s current concepts, making an assessment of its believability, and adjusting beliefs accordingly. This has come to be called “personal epistemology,” a construct that has generated much research.

**Conceptual Change and Piagetian traditions in learning theory**

The Conceptual Change tradition was an alternative to experimental, scientific Piagetian studies of children’s reasoning and learning in science that had been at the forefront of educational research since the “rediscovery” of Piaget by Anglo-Americans in the early 1960s (Novak 1977). This Piagetian research powerfully influenced the crop of “Alphabet Curricula” or “Sputnik Curricula” commissioned by the US National Science Foundation (NSF) in the 1960s that extolled inquiry and hands-on experiential learning in classrooms (Crane 1976).

David Ausubel wrote, when commenting 50 years ago on the then National Science Foundation’s enthusiasm for “discovery based” school curricula:

Actually, a moment’s reflection should convince anyone that most of what he really knows and meaningfully understands, consists of insights discovered by others which have been communicated to him in meaningful fashion.

(Ausubel 1964, p. 291)

That so many educators were oblivious to this basic point which is fundamental for the existence and transmission of culture is a mystery. The point is especially important for proponents of student-centered learning and teaching because the step from “student-centered learning” to “discovery learning” seems so natural: what could be more student-centered than discovery learning? Yet the latter is demonstrably a complete pedagogical failure as well as being philosophically naive.
Against behaviorism

Although Conceptual Change and Piagetian traditions were competing and oft-antagonistic traditions (Lawson 1993; Shayer 1993) they were united in taking children’s thinking, ideas and individuality seriously. Piagetians studied individual children. They observed them manipulating standardized objects (pendulums, deformable objects), they talked to and questioned them and they gave them pencil and paper tests. Engagement with the individual subject was paramount in their research. Both traditions were cognitivists; they were united in opposition to behaviorist learning theory and its Skinnerian token-economy and operant-conditioning reinforcement regimes in classrooms (Skinner 1971; Thoresen 1973). They both thought that something was “going on in the head” when learning occurred and researchers needed to shed light on what that was; behavior was an outcome or indicator of learning it was not the learning.

Both traditions – Conceptual Change and Piagetian – were constructivist. Jon Magoon, who introduced the term “constructivism” into educational research, pointed out that “the major influence toward a more constructivist psychology, however, has been the research and writing of Jean Piaget” (Magoon 1977, p. 662). All Piagetians agree with this: the mind is structured, it has defined processing mechanisms, and the structure and mechanisms change with maturation and experience. External stimuli, including verbal stimuli, are not just stamped on the mind, they are processed; the mind is active; it is constructive.

Although both are constructivist, they have been identified with separate labels. The first being called “social constructivism”; the second “personal constructivism” or sometimes “psychological constructivism.” Social constructivism is heterogeneous. Contained within it are a wide range of epistemological, ontological and pedagogical positions. Piagetian personal constructivism is more homogeneous; it contributes less philosophical variance to the constructivist family (Kitchener 1986). Social constructivism commits to the Hegelian notion that the “The ‘we think’ determines the ‘I think.’” This is an affirmation given wide currency in education by Paulo Freire. Personal ideas, cognition, and knowledge are dependent upon the cognitive furniture of the society and culture of the individual. Social constructivism stands against any individualist “Robinson Crusoe” understanding of cognition.

The constructivist family is certainly a “broad Church.” At least the following varieties have been identified and defended in publications: contextual, dialectical, empirical, information-processing, methodological, moderate, Piagetian, post-epistemological, pragmatic, radical, realist, social, sociohistorical humanistic constructivism, didactic constructivism, socio-transformative constructivism, and situative constructivism. It is manifestly a difficult theory to pin down. This is acknowledged by its one-time major champion in science education:

As we have thought about constructivism, we have come to realize that it is not a unitary construct. Every day we learn something new about constructivism. Like the bird in flight it has an elusive elegance that remains just beyond our grasp.

(Tobin & Tippins 1993, p. 20)

Just how anything that remains permanently “beyond our grasp” can be a theory of learning, a guide for research, or much assistance for teachers, is not explained. Such an admission from a lead theorist should caution those tempted to embrace, much less champion the position.

Expansion of social constructivism

Social constructivism had its origins as a theory of children’s learning, but it expanded to encompass the whole domain of educational inquiry. This can be seen in the subheadings of one
science education article: “A constructivist view of learning,” “A constructivist view of teaching,” “A view of science,” “Aims of science education,” “A constructivist view of curriculum” and “A constructivist view of curriculum development” (Bell 1991). For many constructivists, the theory became a worldview or Weltanschauung:

Constructivism offers a viable alternative view of knowledge, reality, science and education. . . . The constructivist view of education provides us with a hope for the future as individuals value their own and others’ understandings, take responsibility for their own destinies, and lead us forward into a changing but promising world.

(Davis et al. 1993, pp. 628, 635)

Or, in Ken Tobin’s autobiographical revelation:

To become a constructivist is to use constructivism as a referent for thoughts and actions. That is to say when thinking or acting, beliefs associated with constructivism assume a higher value than other beliefs. For a variety of reasons the process is not easy.

(Tobin 1991, p. 1)

A leading advocate and recipient of many prestigious prizes, co-authored a piece in 1994 that starkly asserts that the educational goal of constructivists is to turn students into constructivists:

Thus, science educators seek to help teachers in changing from worldviews that are commensurable with objectivism to ones that are commensurable with constructivism.

(Roth & Roychoudhury 1994, p. 6)

Constructivism, in these accounts, has all the marks of an ideology, of a statement of faith; in the quotation, “constructivism” could easily be replaced with “communism,” “Catholicism,” “Islam,” “Maoism” or any other such overarching worldview and ideology. In education conferences of the 1980s and 1990s, constructivist fervor was palpable.

Constructivism and Thomas Kuhn

Thomas Kuhn has arguably been the most culturally influential historian of science in the 20th century. His impact has been felt in all academic fields, and even beyond the academy. The first edition (1962) of his Structure of Scientific Revolutions sat largely unexamined on the publisher’s floor, read only by a minority of historians and philosophers of science; the second edition (1970) exploded over the philosophical and more generally scholarly communities.

Educational constructivism came into being at the same time as the 1960s Kuhn-led revolution in philosophy of science. Kuhnism turned the heads of educators who rushed lemming-like over the Kuhnian cliff. They constituted a “Kuhnian cheer squad,” in the words of two researchers (Loving & Cobern 2000). Joseph Novak, as with so many educators and scholars from all disciplines, was awed by Kuhn and the “new wave” in historical-relativist philosophy of science that Kuhn’s Structure of Scientific Revolutions (Kuhn 1962) launched:

In philosophy, a consensus emerges that positivism is neither a valid nor a productive view of epistemology. . . . What is emerging is a constructivist view of epistemology, building on ideas of Kuhn (1962), Toulmin (1972) and others.

(Novak 1977, pp. 5–6)
It is telling that Novak in his autobiography says that although he carefully read Conant and Toulmin, he did not do the same for Kuhn (Novak 2018, p. 132). Novak is not alone in this: educators rarely study the arguments of philosophers, nor indeed of psychologists. Despite teaching subjects reliant, or parasitic on, these fields, they do not study them as a discipline; at most they are a subject in a graduate program.

Peter Fensham in his comprehensive study of the research discipline of science education remarked that lack of rigorous preparation for science education research is evidenced by the extent of shallow learning theory in the field, saying that “science educators borrow psychological theories of learning . . . for example Bruner, Gagne and Piaget” (Fensham 2004, p. 105). And he goes on to say, damningly, that “The influence of these borrowings is better described as the lifting of slogan-like ideas from these theories” (ibid.). Even more slogan-like is the lifting of philosophical ideas. A casual glance at any multicultural, critical theory or cultural studies volume confirms this.

Largely on account of the unfortunate separation of education departments from philosophy departments and the stripping of philosophy from teacher education and graduate programs, educators did not see the detailed criticisms of Kuhn that were advanced in the history and philosophy of science community. These began with Dudley Shapere, who acknowledged the “vast amount of positive value in Kuhn’s book” (Shapere 1964, p. 393), but went on to argue that his truly revolutionary account of theory change in the history of science

is made to appear convincing only by inflating the definition of “paradigm” until that term becomes so vague and ambiguous that it cannot easily be withheld, so general that it cannot easily be applied, so mysterious that it cannot help explain, and so misleading that it is a positive hindrance to the understanding of some central aspects of science; and then, finally, these excesses must be counterbalanced by qualifications that simply contradict them.

(Shapere 1964, p. 393)

Israel Scheffler advanced an 11-point critique of Kuhn’s arguments, one of which dealt with Kuhn’s charge of irrationality in paradigm choice:

[it] fails utterly, for it rests on a confusion. It fails to make the critical distinction between those standards or criteria which are internal to a paradigm, and those by which the paradigm is itself judged.

(Scheffler 1966, p. 84)

Alexander Bird provided a sympathetic appraisal of Thomas Kuhn but correctly maintained that Kuhn’s treatment of philosophical ideas is neither systematic nor rigorous. He rarely engaged in the stock-in-trade of modern philosophers, the careful and precise analysis of the details of other philosopher’s views, and when he did so the results were not encouraging.

(Bird 2000, p. ix)

The historian Jan Golinski wrote:

I see Kuhn as having little positive influence on philosophers and almost none (directly) on historians. His most significant influence within science studies was mediated by sociologists, whose reading of his work he specifically repudiated.

(Golinski 2012, p. 15)
Wolfgang Stegmüller opined that the crux of Kuhn’s theory of science was “a bit of musing” of a philosophical incompetent (Stegmüller 1976, p. 216). Mario Bunge recounts in his autobiography that he attended an influential 1966 colloquium on causality convened in Geneva by Piaget in which Kuhn participated. Bunge observed:

Kuhn’s presentation impressed no one at the meeting, and it confirmed my impression that his history of science was second-hand, his philosophy confused and backward, and his sociology of science non-existent.

(Bunge 2016, p. 181)

Not only did educators miss the initial criticisms, but they also missed Kuhn’s recanting of his positions. In his Robert and Maurine Rothschild lecture at Harvard University in 1991, he appraised the sociological turn in the history and philosophy of science, acknowledging that it was “emphasized and developed by people who often called themselves Kuhnians” (Kuhn 1991, p. 3), but added that “I think their viewpoints damagingly mistaken, have been pained to be associated with it, and have for years attributed that association to misunderstanding” (ibid.). In reviewing his achievements, he regretted writing the “purple passages” in Structures. Unfortunately, it was often these passages that were taken up in the education community. By the time Kuhn regretted them and tried to close the stable door, they had bolted out into the text of thousands of higher degrees, articles and books. For him to say “sorry” is hardly sufficient; it does not atone for the enormous damage his “casual” or “misinterpreted” relativism wreaked on graduate student minds, and more generally on the academy and beyond. Philosophers should demonstrate more care in their writing; “purple passages” should not go unnoticed. But as Kuhn says, he was never trained in philosophy.

The Kuhnian revolution had disastrous effects in education. Two generations of educators were lost in a Kuhnian landscape in which notions of “paradigm,” “incommensurability,” “conversion,” “different worlds” and so on confused discussion, hampered research and dimmed whatever light might be shed on real educational and social problems (Matthews 2004).

**Constructivism, epistemology and learning theory**

Kenneth Strike outlines the common social constructivist position that learning is primarily the task of relating what one has encountered in the world and in classrooms, to one’s current concepts and expanding or adjusting beliefs as need be. This task means making an assessment of believability or reliability of beliefs. Many educators embrace this account of meaningful learning, but Strike says that the account has one unexpected implication:

The result is that it is epistemology, not psychology that is the basic discipline for the study of learning. It is after all epistemology which is the discipline which is supposed to describe what counts as rationality.

(Strike 1983, p. 69)

This should not be a surprise, as epistemology and psychology were conjoined in the writings of the founders of educational constructivism – Piaget, Vygotsky and Bruner. Piaget called this own theory “Genetic Epistemology,” and this philosophical concern is reflected in his book title – *Psychology and Epistemology* (Piaget 1972). Jerome Bruner, speaking of his famous *Process of Education* book (Bruner 1960) that presented a constructivist alternative to didactic, transmissionist, behaviorist-informed “banking” pedagogy, to use Freire’s expression, wrote that
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its ideas sprang from epistemology and the sciences of knowing . . . all of us were, I think, responding to the same “epistemic” malaise, the doubts about the nature of knowing that had come first out of the revolution in physics and then been formalized and amplified by philosophy.

(Bruner 1983, p. 186)

The major question for researchers, teachers and philosophers embracing this theory, was, what constitutes rational change? This, obviously, is not an empirical question, it is an epistemological question, and typically education researchers were not well prepared to answer it. Philosophy of education has been stripped out of teacher education programs everywhere; philosophy rarely features in education graduate programs.

Problems with constructivist epistemology

Constructivism emphasizes that science is a creative human endeavor which is historically and culturally conditioned, and that its knowledge claims are not absolute. This is certainly worth saying, but it is a truism shared by all philosophers and historians of science. Beyond this widely agreed truism, constructivism is committed to certain epistemological positions that are keenly disputed. At its core, social constructivism has a subjectivist and empiricist understanding of human knowledge and consequently of scientific knowledge. As one of the most influential constructivists in science and mathematics education has put it:

Knowledge is the result of an individual subject’s constructive activity, not a commodity that somehow resides outside the knower and can be conveyed or instilled by diligent perception or linguistic communication.

(Von Glaserfeld 1990a, p. 37)

Constructivists are epistemological relativists. Consider, for example:

The constructivist epistemology asserts that the only tools available to a knower are the senses. It is only through seeing, hearing, touching, smelling, and tasting that an individual interacts with the environment. With these messages from the senses the individual builds a picture of the world. Therefore, constructivism asserts that knowledge resides in individuals.

(Lorsbach & Tobin 1992, p. 5)

And:

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

(Confrey 1990, p. 108)

And further:

The theory of constructivism rests on two main principles. . . . Principle one states that knowledge is not passively received, but is actively built up by the cognizing
subject. . . . Principle two states that the function of cognition is adaptive and serves
the organisation of the experiential world, not the discovery of ontological reality. . . .
Thus we do not find truth but construct viable explanations of our experiences.
(Wheatley 1991, p. 10)

Such relativism has its philosophical problems, and these have been pointed out by many (Nola
1988; Norris 1997; Siegel 1987).

Although children’s thoughts are private, their concepts are public. Whether or not particu-
lar beliefs are going to constitute knowledge is not a matter for the individual to determine; or
rather, if they do so determine, then it is with reference to a public standard. These, and other
considerations, led David Hamlyn to say:

any view which in effect construes the child as a solitary inquirer attempting to dis-
cover the truth about the world must be rejected. (What after all could be meant by
‘truth’ in these circumstances?)

(Hamlyn 1973, p. 184)

This does lead to issues about what, and how many, constitute “public.” One constructivist arti-
cle is titled: “In the Name of Constructivism: Science Education Research and the Construc-
tion of Local Knowledge” (Roth 1993). The title reflects the anti-universalist “all knowledge
is local” mantra, but still it requires some specification of “local” and what are the processes of
separating, even at a local level, opinion from knowledge. Parallel problems with “human rights
are local” or “women’s rights are local” should be obvious.

Clearly lots of different things can “make sense” to people, and people can disagree about
whether a particular proposition makes sense to them or does not make sense. The ways in
which a proposition can make sense are independent of the reference of the proposition; it
depends on the meaning. Matters about the truth of a proposition are not so relaxed; they
depend upon how the world is and what claims we make about it. Consequently, “making
sense” is a very unstable plank with which to prop up curriculum proposals and adjudicate
debates about curriculum content.

Furthermore, most scientific advances have entailed commitment to propositions that literally
defied sense – Copernicus’ rotating earth, Galileo’s point masses and colourless bodies, Newton’s
inertial systems that in principle cannot be experienced and also his ideas of action at a distance,
Darwin’s gradualist evolutionary assumptions so at odds with the fossil record, Einstein’s mass–energy
equivalence and so forth (Cromer 1993). The routine topic of pendulum motion exhibits the prob-
lems with using “making sense” as a goal and arbiter in science education. In classical mechanics,
the bob at its highest point is both at rest and accelerating with the acceleration of gravity; at its
lowest point it is moving with maximum speed in a tangential direction, yet its acceleration is verti-
cally upwards. Neither of these propositions makes immediate sense, yet they are consequences of
the physical theory that allows construction of the pendulum clock and successful predictions to be
made about the motion of pendulums. Within the Newtonian theory of circular motion, the prop-
ositions “make sense.” But Newtonian theory does not emerge from sensations; and not only is it
not traceable to experience, it contradicts immediate experience; it is only approximately in accord
with refined, experimental experience. This is why Lewis Wolpert, among others, comments that

if something fits in with common sense it almost certainly isn’t science. . . . the way in
which the universe works is not the way in which common sense works.
(Wolpert 1992, p. 11)
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Relativism is one problem, and serious enough; but of orders more serious is when constructivism segues into complete skepticism, the view that we cannot have any knowledge of nature, its structure or properties. This is not skepticism about any particular claim (e.g., that a gremlin ate the student’s essay) but global skepticism about all claims concerning the world. Constructivists constantly assert that we have no direct access to reality, that reality remains forever hidden. The opposing “commonsense realism” view was nicely stated by Moritz Schlick in 1935 when he opposed the metaphysics of his fellow positivists Carnap and Neurath:

I have been accused of maintaining that statements can be compared with facts. I plead guilty. I have maintained this. But I protest against my punishment: I refuse to sit in the seat of the metaphysicians. I have often compared propositions to facts; so I had no reason to suppose that it couldn’t be done. I found, for instance, in my Baedeker the statement: “this cathedral has two spires.” I was able to compare it with “reality” by looking at the cathedral, and this comparison convinced me that Baedeker’s assertion was true. (Schlick 1935, pp. 65–66, in Nola 2003, p. 146)

Schlick’s “tourist” argument of course applies at the next level down. Viruses, bacteria, molecules and a host of microscopic entities were once only postulated and were indeed inaccessible to scientists and everyone else, but with refined technology they become as visible to students in laboratories as were Schlick’s cathedral spires to the tourist walking through town.

Problems with constructivist ontology

Constructivists often embrace an idealist ontology, or idealist theory about the existential status of scientific and everyday objects; that is, they variously maintain that the world is created by and dependent upon human thought. Various Kuhn-inspired sociologists of science repeatedly state that different observers “live in different worlds” and that they create those worlds. These astounding claims pass over the major ambiguity: on the one hand, the complete truism that different observers and different groups have different experiences; on the other, that the world in which they live varies from observer to observer and group to group. The latter is not a truism and requires some argument, as does the more advanced claim that these various worlds are created by the observer. Kenneth Gergen, an influential social constructivist, expresses this position, saying there is “a multiplicity of ways in which “the world” is, and can be, constructed” (Gergen 1994, p. 82).

Educational idealism

Ernst von Glasersfeld’s radical constructivism is the best-known idealist variant in education. He says:

The realist believes his constructs to be a replica or reflection of independently existing structures, while the constructivist remains aware of the experiencer’s role as originator of all structures . . . for the constructivist there are no structures other than those which the knower constitutes by his very own activity of coordination of experiential particles.

(Von Glasersfeld 1987, p. 104)

Realists need not make any such claims about “replication” and “reflection”; they indeed make claims about the world but recognise that “there is more to seeing than meets the eyeball” and
the claims are the outcome of social, personal and cultural circumstance. Elsewhere, von Glaserfeld writes:

I can no more walk through the desk in front of me than I can argue that black is white at one and the same time. What constrains me, however, is not quite the same thing in the two cases. That the desk constitutes an obstacle to my physical movement is due to the particular distinctions my sensor system enables me to make and to the particular way in which I have come to coordinate them. Indeed, if I now could walk through the desk, it would no longer fit the abstraction I have made in prior experience.

(Von Glaserfeld 1990b, p. 24)

This argument has problems. For the realist, the inability of our body to “walk through” another body has nothing to do with our sensory powers but everything to do with the composition and structures of the bodies. Changing our sensory powers will no more allow us to walk through a hitherto impenetrable table than changing our shirt would allow us to do so. Upon dying we lose all sensory powers, but this does not mean our body can then penetrate a table. Our having or not having sensory powers makes no difference to the penetrability of the table; to think that it does is just philosophical idealism.

Observations and theory clearly depend upon us, but not the objects observed or their structures. Philosophical alarm bells should ring when an author runs together “observations” with “events” and “objects.” For a realist, and for any serious scientist, there are categorical differences between these classes. Only a philosophical idealist can run them together without alarm bells ringing; and when they do ring the idealist case has to be argued, not just assumed.

Rosalind Driver, a rightly famous and influential science educator, frequently affirmed the idealist position. For instance:

science as public knowledge is not so much a “discovery” as a carefully checked “construction” . . . and that scientists construct theoretical entities (magnetic fields, genes, electron orbitals . . . ) which in turn take on a “reality.”

(Driver 1988, p. 137)

Here it is being said that the earth does not have a structure until geophysicists impose it; there is not an evolutionary structure in the animal world till biologists impose such structure; atoms have no structure until such is imposed by physicists; and so on. One might ask: if gravity waves are our creation, why spend so much time and money looking for them?

Despite Driver’s basic argument form being fallacious, it is nevertheless widespread. The argument has the form:

Premise: Some concept is a human construction.
Conclusion: Therefore the referent of the concept does not exist.

One only has to state this argument to see that it is an invalid inference, and its validity depends upon making explicit a suppressed premise of the form:

Suppressed premise: All concepts that are human constructions can have no existential reference.

But this suppressed premise is simply dogma for which no evidence is provided. Not only are “electron orbitals” and “magnetic fields” human constructions, but so also are “my house,”
“mountain,” “table” and all the other observational terms we use. If the foregoing widespread constructivist argument, utilized by Rosalind Driver, were valid, then not only would electron orbitals not exist, neither would our house, the tables in it, nor mountains that we might live near. Indeed, given that the personal pronoun “I” is a human construction, individual cognizing subjects might not exist. But such considerations are frequently dismissed as “philosophical quibbles.”

Wallis Suchting provided a detailed, philosophically informed, line-by-line critique of von Glasersfeld’s hugely popular version of constructivism, concluding that:

First, much of the doctrine known as ‘constructivism’ . . . is simply unintelligible. Second, to the extent that it is intelligible . . . it is simply confused. Third, there is a complete absence of any argument for whatever positions can be made out. . . . In general, far from being what it is claimed to be, namely, the New Age in philosophy of science, an even slightly perceptive ear can detect the familiar voice of a really quite primitive, traditional subjectivist empiricism with some overtones of diverse provenance like Piaget and Kuhn.

(Suchting 1992, p. 247)

Constructivists simply ignored this lengthy and detailed critique of their position; the philosophical dogs barked, but the constructivist caravan moved on across the educational landscape.

**Sociological idealism**

The ontological idealism embraced by educational constructivists mirrors and is encouraged by a comparable idealism common among new-style, post-Mertonian sociologists of science, particularly those associated with the Edinburgh school, so-called Strong Programme in Sociology of Science. This movement can be called “sociological constructivism” as distinguished from the two branches of educational constructivism – “social constructivism” (conceptual change program) and “personal constructivism” (Piagetian program). All of the “new wave” sociologists of scientific knowledge express their indebtedness to Thomas Kuhn for uncovering the pretences of “old time” positivist and empiricist accounts of science. Two leaders, Bruno Latour and Steve Woolgar, claim that “out-there-ness” is the *consequence* of scientific work rather than its *cause* (Latour & Woolgar 1986, p. 182). They go on to say that reality is the consequence rather than the cause of scientific construction. Woolgar says of his research program that it

is consistent with the position of the idealist wing of ethnomethodology that there is no reality independent of the words (texts, signs, documents, and so on) used to apprehend it. In other words, reality is constituted in and through discourse.

(Woolgar 1986, p. 312)

The fact that the theoretical apparatus is humanly constructed, and that natural objects are considered in science only in their theoretical dress – apples as point masses in physics and exchange values in economics – does not imply that the real objects are human creations or that the real objects have no part in the appraisal of the scientific worth of the conceptual structures brought to bear upon them. The ontological idealism of the Edinburgh Programme has been delineated and critiqued by many (Bunge 1991, 1992; Laudan 1984; Slezak 1994).
Peter Slezak provided an admirable, detailed refutation of the Edinburgh Strong Programme’s work and drew attention to its deleterious educational consequences:

If beliefs are intrinsically the products of “external” factors such as social causes and interests rather than “internal” considerations of evidence and reason, then it is an illusion to imagine that education might serve to instil the capacity for critical thought. . . . On these views the very distinction between education and indoctrination becomes otiose; ideas are merely ideology, and pedagogy is merely propaganda.

(Slezak 1994, p. 266)

Cultural consequences of constructivism

Constructivism is fraught with grave educational and cultural implications that are seldom recognized, much less engaged with.

Transmission of culture

All cultures build up traditions and understandings that they pass on in formal and informal settings. Having such traditions is the hallmark of a healthy culture. Each new generation does not have to start completely anew the task of making meaning. Radical constructivism, with its in-principle aversion to transmission of knowledge, makes tradition nugatory; indeed, if it is seriously adopted it destroys traditional culture. The core of traditional, indeed any healthy, culture is the transmission of the culture’s beliefs and mores; it is plainly ridiculous, and culture destroying, for constructivists to maintain that putative knowledge cannot be so transmitted. For a liberal, cultural knowledge and understanding need to be transmitted; children should understand the knowledge repository of their culture but also be given the competence and freedom to appraise it.

Appraisal of culture

It is notorious that people have for centuries thought that the grossest injustices, and the greatest evils, have all made sense. The subjection of women to men has, and still does, make perfectly good sense to millions of people and to scores of societies; explaining illness in terms of possession by evil spirits makes perfectly good sense to countless millions; the intellectual inferiority of particular races is perfectly sensible to millions of people, including some of the most advanced thinkers; to very sophisticated Germans it made sense to regard Jewish people as sub-humans and to institute extermination programs for them; apartheid made sense to South Africans just as racial discrimination did to US citizens until very recently. The list of atrocities and stupidities that have made perfect sense at some time or other, or in some place or other, is endless. It seems clear that the appeal to sense is not going to be sufficient to refute such views. But the appeal to truth, or right, which is independent of human desires or power, may be able to overturn such opinions and practices. The interests of the less powerful and marginalized are not advanced by championing the view that power is truth; minority rights have always been better advanced by holding on to the view that truth is power. Michael Devitt recognized these and other problems, when he commented that:

I have a candidate for the most dangerous contemporary intellectual tendency, it is . . . constructivism. Constructivism is a combination of two Kantian ideas with
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twentieth-century relativism. The two Kantian ideas are, first, that we make the known world by imposing concepts, and, second, that the independent world is (at most) a mere ‘thing-in-itself’ forever beyond our ken . . . [considering] its role in France, in the social sciences, in literature departments, and in some largely well-meaning, but confused, political movements [it] has led to a veritable epidemic of ‘world-making.’ Constructivism attacks the immune system that saves us from silliness.

(Devitt 1991, p. ix)

Whither constructivism?

After sustained philosophical criticism and more recently refutation of its claims to be a guide for successful pedagogy (Kirschner et al. 2006), there are signs that constructivist influence is waning. Thirty years ago there were hundreds of constructivist presentations at the US annual National Association for Research in Science Teaching (NARST) and American Educational Research Association (AERA) conferences; in recent years only a handful of papers having “constructivism” in their title could be found on the program. The Constructivist Special Interest Group (SIG) at AERA has basically closed up its shop, having just four papers in 2015. The most energetic figure in the field has “Moved On” (Tobin 2000); while another enthusiast abandoned constructivism because “it turned out to be plagued with considerable contradictions” (Roth 2006, p. 326). Most have moved on to critical studies or cultural studies (McCarthy 2018) but have taken constructivism with them. For Ken Tobin:

In contrast to the mainstream of research in science education, I advocate a multilogical methodology that embraces incommensurability, polysemy, subjectivity, and polyphony as a means of preserving the integrity and potential of knowledge systems to generate and maintain disparate perspectives, outcomes, and implications for practice. In such a multilogical model, power discourses such as Western medicine carry no greater weight than complementary knowledge systems that may have been marginalized in a social world in which monosemia is dominant.

(Tobin 2015, p. 3)

Who knows what this means? It is certainly “beyond the grasp” of all but the most sophisticated initiates. How can something “beyond the grasp” ever be a basis for educational practice and curriculum development?

Conclusion

Constructivism has provided benefits to education. It has alerted teachers to the function of prior learning and extant concepts in the process of learning new material; it has stressed the importance of understanding as a goal of science instruction; it has promoted pupil engagement in lessons and other such progressive matters. But liberal educationalists can rightly say that these are pedagogical commonplaces that go back at least to Socrates, who initiated the questioning or Socratic method of pedagogy, and included the medievals who standardly had to present arguments against their theses and then answer these. Assertion, criticism and resolution was the staple of medieval philosophy. It is clear that the best of constructivist pedagogy can be had without constructivist epistemology – Socrates, Aquinas, Montaigne, Locke, Mill, and Russell are just some who have conjoined engaging, constructivist-like pedagogy with non-constructivist epistemology and realist ontology.
Constructivism has also done a service by making educators aware of the human dimension of science: its fallibility, its connection to culture and interests, the place of convention in scientific theory, the historicity of concepts, the complex procedures of theory appraisal, and much else. But again, realist philosophers can rightly maintain that constructivism does not have a monopoly on these insights; they are learned in any introductory history and philosophy of science course. In brief: everything good in constructivism has been long known, while most, if not everything, novel is mistaken and misguided.

Notoriously, fads come and go in education. Constructivism is one of them. Sadly generations of graduate students have had their precious learning-time wasted reading shallow, philosophically ill-informed literature; and hundreds of thousands, if not millions, of students around the world have left school with minimum competence in mathematics, science and reading, on account of being poorly taught in constructivist classes (Matthews 2015, pp. 782–794). This because so many teachers signed up to the “no guidance” mantra that:

Constructivist teachers view themselves as gardeners, tour guides, learning councillors or facilitators rather than dispensers of information or judges of right and wrong answers.

(Roth & Roychoudhury 1994, p. 27)

The challenge for student-centered learning and teaching is to develop its program in a way that affirms all the better and supported affirmations of constructivism while avoiding the now-discredited epistemological, ontological and pedagogical facets that have become associated with the doctrine. The liberal education tradition, especially its more substantial philosophical defenders (Cuypers & Martin 2011; Peters 1966), provides one substantial resource for this challenge. There are others.

References

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Michael R. Matthews


