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Wittgensteinian Perspectives and Science Education Research

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Synonyms

Ludwig wittgenstein; Peter winch; Science learning;

Introduction

As one of the most influential philosophers of the twentieth century, Ludwig Wittgenstein (1889–1951) has impacted a variety of scholarly disciplines, including education theory and research. Wittgenstein's later works are often cited for their insights into a wide variety of philosophical topics, including meaning and understanding, rule following, the "inner" and "outer" realms of human activity, and certainty about knowledge. In contrast to the representationalist view of language expressed in his earlier work, these writings identify the meaning of an expression as its rule-governed use in language, inextricably tied to its use in our lives.

Wittgenstein's name has been invoked with increasing regularity, especially since what might be termed the "social turn" in research on learning in (science) education, including interest in the role of discursive interaction in human development and in sociological studies of scientific practice. Less understood but no less significant in education research are the implications of Wittgenstein's vision of an alternative orientation for philosophy and, in turn, the impact of this vision on theory and research in the various human sciences. Wittgenstein claimed that frustration with psychology should not be mistaken for problems related to its being an underdeveloped science. Rather, he faulted "conceptual confusions" in which prescribed methods are thought to deliver solutions to problems but instead miss the mark entirely.

Extending these Wittgensteinian points, philosopher Peter Winch argued that social science is much more conceptual than empirical and that the proper understanding of meaningful human action involves dialectical examination of language use. Producing empirical evidence to satisfy an essentially conceptual question – for example, concern with identifying the "most effective instructional method" or even "what was learned in a laboratory exercise" – results in begging the question, regardless of the depth of care we take in specifying operational definitions. Most theories that get adopted in education

research end up simply replacing the answers given to the perpetual problems of educational practice while leaving central analytic orientations intact; Wittgenstein's and Winch's notions force us to examine whether education researchers should instead fundamentally change the questions that are asked.

Wittgenstein's Philosophy

Numerous summaries of Wittgenstein's biography and philosophical contributions exist; only broad arguments related most directly to the uptake of his work in science education are given here. As outlined in *Philosophical Investigations* (Wittgenstein 1958) and other posthumously organized collections of his vast notes and dialectical exemplars, Wittgenstein's later work was concerned with pointing to the unrelieved role of grammar in philosophical puzzles. Wittgenstein proposed time and again that philosophical difficulties were often the result of a lack of clarity surrounding our concepts; certain expressions (e.g., "to be" or "to exist") continually lure us into supposed philosophical crises, whereas examining the expression's logic in use suggests a "therapeutic" alternative analysis and resolution.

The analysis of the meaning of an expression relies on examination of its ordinary use in our lives, use that is embedded in what Wittgenstein referred to as "language games." A language game is essentially a grammar of practice, rule governed, and knowable to competent speakers of a language. It is sometimes assumed that philosophy's task is to produce solutions to puzzles of meaning and existence, akin to the natural sciences' aim to produce causal explanations of observed patterns and relationships. Again, however, for Wittgenstein, the goal of philosophy properly conceived is to produce clarifying descriptions of the rule-governed use of concepts in our various language games.

One question raised by Wittgenstein's philosophy concerns the source of the aforementioned rules: is it in fact the case that the origin of these rules is what is in need of explanation? And if it is

not the task of philosophy to produce this explanation, perhaps this is the rightful role of linguistics or social science more generally? Although some have certainly advanced this interpretation of Wittgenstein, a more common response is to point to his numerous references to the commonly perceived but sorely misguided need to secure the foundations of all knowledge. Rather than suggesting a skeptical interpretation of his discussions of rule following, Wittgensteinian philosophers such as Peter Hacker (1999) and Cora Diamond (1989) urge us to understand his writings as pointing to the way that rules exist against a background of modes of living in and talking about the world; rules and contexts are mutually constitutive rather than causally emergent and in need of explanation.

Wittgenstein's insistence on the rule-governed nature of our lives may also be heard as validation of scholars who insist on the primacy of social, rather than psychological, explanations of human behavior. It is the case that Wittgenstein discusses and rejects the idea of a "private language" – the notion that an individual attaches unique names to individual experiences, and this creates an "inner world" known only to himself (e.g., see Hacker 1999). Typically, however, Wittgenstein should be interpreted not as "taking sides" in a familiar battle but as resetting the terms of the debate; in this case, it is not so much the triumph of "social" over "individual" worlds that is noteworthy but, rather, the way in which the "inner-outer divide" itself can be seen as illusory and a product of our ways of speaking rather than a conundrum in desperate need of resolution.

Related to this critique of the mind-body (or more contemporary brain-body) dualism, Wittgenstein is largely seen as having dismantled a representationalist view of language. "Representationalist" refers to the notion that language ties to and names the world, such that its use is indicative of something lying behind it; language "stands for" or "points to" something, in the way that announcing "I am hungry" is sometimes thought to imply that the speaker is translating introspection into words, orienting to her inner condition in order to communicate with others. Alternatively, stating "I am hungry" can be seen

simply as a rule-governed behavior we engage in (rather than, e.g., crying or enduring the pain of an empty stomach). It is a subtle distinction to talk of language as expressing rather than representing. And of course, language *can* be used to represent, or to name – Wittgenstein challenges us to see that representing is but *one* use for language, not a fundamental, singular, or universal relationship between language and the world.

Influence in Science Education Research

In order to appreciate the influence of Wittgenstein's writings in science education research, it is helpful to have a general outline of studies of student learning in the field. While consensus on the approach to research or even the goal of inquiry is not readily apparent, the overwhelming focus has been on *students' understanding of scientific concepts*. Conceptual learning has been and is often still thought of as the acquisition or restructuring of individual mental representations. Increasingly, though, language and social interaction have been viewed as critical in shaping these mental representations; in some cases, the notion of concept-as-mental-representation has been called into question. Attempts to determine the causal relevance of other factors such as motivation, attitude, elements of individual identities, learning environments, or other "internal" or "external" characteristics have also been undertaken.

In relation to research on students' learning in science, Wittgenstein's philosophy has been invoked in at least four broad ways over the last several decades (Heckler 2014). Early dissenters to the emerging "conceptual change" theory of cognitive learning in science as analogous to rational theory replacement in the discipline of science argued against the plausibility of novice students' ability to logically justify and appropriate scientifically superior counterparts to their naïve and unworkable explanations of the world. Wittgenstein's writings were used to emphasize the nonrational aspects of human interaction (persuasion versus reason; learning by imitation and training) or to point to multiple and local rationalities as more relevant to the student's task than a universal scientific logic.

A second strand of research has enlisted Wittgenstein in the project of theorizing student learning as a sociocultural rather than individual-psychological process. Students' acquisition of scientific concepts was characterized as successful participation in a scientific language game. Most theorists argued for a picture of learning that involved a combination of "individual" and "social" elements, for example, appropriate language performance as evidence of a scientific concept correctly internalized. However, occasionally Wittgenstein's philosophy has been used in science education to argue for rejecting the individual-social dichotomy and any sense of a uniquely individual cognition.

The introduction and use of the science studies literature – broadly, sociological, historical and philosophical inquiries into scientific practice as it occurs in particular settings, on particular occasions – in science education provided a third opening for the use of Wittgenstein's philosophy. An interest in science studies grew out of the sociocultural in research on science learning; rather than imagine logical scientific theory change as a cognitive development, investigators studied science classrooms as sites of scientific practice (and concept development), inspired by methods and arguments from science studies. The path to Wittgenstein here is somewhat indirect, but emanates largely from the writings of David Bloor, who as spokesperson for the "Edinburgh Strong Programme" in science studies argued (following Saul Kripke) that Wittgenstein's discussion of rule following licensed a skeptical interpretation: that if we can't point to empirically derived, natural causes for the rules we follow in various forms of practice (including rules for language use), the explanation must lie in social consensus, the formation of which should be studied and understood theoretically. This social-constructivist approach to explaining how students come to understand science in classroom settings was embraced by science education researchers beginning in the mid-to-late 1990s.

Finally, Wittgenstein's writings have inspired discussion of new methodologies in researching

students' science learning. The most robust of these has been known as "practical epistemology analysis," which involves analyzing transcripts of science learning activities, in order to pinpoint where students have difficulty understanding and how that difficulty is resolved via known concepts. Wittgenstein's notion of meanings that "stand fast" in relation to their surroundings was combined with the notion of "family resemblance" across language games in order to reimagine and investigate students' acquisition of new conceptual understanding in science. Such analysis was used to describe what students learned from various laboratory practicals and how student-teacher interaction guided learning, to identify metaphors as important connectors between students' established knowledge, and to illustrate students' use of aesthetic judgments in negotiating their participation in a school science classroom, among others.

The Problem of Scientism

Although Wittgenstein's philosophy has been cited in service of studying student learning in science in various ways, the claim has been made that ultimately these references miss the point of his arguments (Heckler 2014). To understand why, it is important to appreciate the undercurrents of anti-scientism (not *antiscience*) at work in Wittgenstein's writings. In this context, "scientism" refers to the tendency to lift up scientific methodology as the preferred (if not sole) source of certain knowledge in all human practices. Many academic disciplines beyond the natural sciences model their modes of inquiry on the empirical methods of the natural sciences. However, we could ask whether some endeavors – for example, aesthetics, ethics, or philosophy more generally – need to emulate this methodology or whether they might rightfully pursue other approaches to generating knowledge. In part, the answer depends on how we think about what is *real*: must the concepts covered by epistemological or metaphysical questions be empirically observable to count as "real?" Lyas (1999) explains how Peter Winch draws from

Wittgenstein in examining just these questions, asking, for example, should empirical linguistics replace philosophy as the source of truth about our use of concepts? Winch's and Wittgenstein's philosophies suggest they would oppose such a conclusion for the study of much of human social life. However, the prevalence of scientistic tendencies across a vast swath of contemporary academic work may suggest a lack of familiarity with the argument – or perhaps, the common, scientistic assumptions behind the current plethora of "methods" and "theories" at play in the social studies are concealed by their seeming differences (Hutchinson et al. 2008).

Education research is not immune to these pressures. In fact, the desirability of a scientific approach to studies in education has been codified by laws such as the *Every Student Succeeds Act* (ESSA) of 2015 (which recently replaced the *No Child Left Behind Act* of 2001). ESSA specifies that educational initiatives deserving of federal funding for implementation and further study must be "evidence based," defined as derived from experimental, quasi-experimental, or correlational studies that have demonstrated a statistically significant effect on student learning outcomes or from rationales for approaches that show promise of scientific validation.

This evidence-based orientation has affected traditional norms of educational practice, as well. For example, curriculum was once idealized as an expression of values or of an educational philosophy tied to its ultimate purpose: educating for individual development, social efficiency, social reform, vocational training, participation in democratic society, social mobility, knowledge replication and production, proof of status, transmission of cultural heritage, exposing and transgressing oppression and injustice, and so on. But increasingly today, curriculum is seen as necessarily tied to "models of student learning"; the curriculum itself must be "evidence based." In a field where research traditions have been summarized as possessing "no rules that everyone follows, no beliefs that everyone shares, no findings that everyone agrees on" (Anderson 2007, p. 3), the assumption that research should set

curricular policy might reasonably be called into question.

Wittgenstein spoke against the analytic tendency to reduce our human understanding of the world to universal concepts and causal relationships – what he called a "craving for generality." But the overwhelming imperative in contemporary education research is indeed to satisfy such a craving. To suggest otherwise invites charges ranging from naiveté to professional incompetence. With occasional exceptions, the use of Wittgenstein's philosophy in science education has *not* been to call for an alternative analytical orientation but, rather, to appropriate singular concepts or notions in service of the familiar ways of seeking to provide explanation for students' learning (or lack thereof) in educational settings. "Language games," "standing fast," "family resemblance," and other Wittgensteinian notions have been used to provide new ways of characterizing students' learning in science, when what is needed instead is an inquiry into whether it makes sense to investigate learning as a process or a causal phenomenon in the first place.

Wittgensteinian Alternatives for Educational Inquiry

Peter Winch, in drawing upon and extending Wittgenstein's philosophy in his book, *The Idea of Social Science and its Relation to Philosophy* (Winch 1990), argued that the study of people is more akin to philosophical than to natural scientific inquiry. One way to summarize it might be this: philosophy (e.g., epistemology) is fundamentally concerned with the nature of human social life but not empirically so. Empirical study (in Winch's sense) reveals something new about the world and in particular about (causal) relationships between objects. But philosophy's interest is in conceptual truths – or how our concepts are related to the world – and typically, this is not new information but information that any competent user of a language knows and can recognize (Lyas 1999). Philosophers remind us of the various ways that concepts are used meaningfully in our lives (Diamond 1989).

To say that the study of social life is more often conceptual than empirical is to assert that such study takes interest in meaningful behavior, and following Wittgenstein, meaningful behavior is rule-governed behavior, dependent on occasion and purpose. We expose and uncover social concepts and relationships by examining what we know about our rule-governed forms of life. Empirical investigation, on the other hand, depends on settling the criteria of what is to be observed. When social concepts are operationalized in order to perform experimental investigations of them, we can give the illusion of discovering new information or of exposing causal generalizations. But the act of operationalizing concepts in order to observe human interaction often masks myriad ways that rules are meaningfully followed and the choices people have in social life. Empirical analysis ends up begging philosophical questions about the occasion- and purpose-bound use of concepts in our lives (Hutchinson et al. 2008).

What might conceptual analysis look like in education research? One example is given in Francis (2005); this critique of radical and social constructivism relies on insights from both Wittgenstein and Winch, as well as analysis of the logic inherent in von Glasersfeld's "radical constructivism" and Bloor's "social constructivism" to illustrate the nonsensical elements of these research agendas. Francis observes that both theories are essentially philosophical arguments purporting to be empirical research programs. Similar critiques might be undertaken of the various theoretical traditions existing in science education research today.

A different approach, no less informed by Wittgensteinian philosophy, guides Macbeth's (2000) analysis of a recorded interview between a young student and a conceptual change researcher. Rather than using the analysis to suggest new theoretical understandings of science learning, Macbeth essentially exposes the logic of alternate "language games" at play during the interaction and foregrounds the way in which the professional analytic practice of a "diagnostic interview" both relies on and simultaneously disavows the student's everyday orientation to questions and

answers in order to ascribe to her various levels of conceptual (mis)understanding.

The difficulty of resisting the urge to theorize, of ignoring the weight of expectations to produce causal explanations of students' learning, or of eschewing the idea that social study should aspire to anything like prediction or control of interactional outcomes should not be underestimated. But the promise of clear and penetrating descriptions of education as rule-governed practice and of useful insights into our understanding of meaningful behavior will perhaps ultimately inspire fidelity to Wittgensteinian perspectives in researchers' future analytic undertakings.

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