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Paper Title: Can a Photograph Have a Misconception?

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Can a Photograph Have a Misconception?

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ABSTRACT

The terms concept and misconception need to be clarified in light of constructivist epistemology. Are misconceptions possible under the tenets of radical constructivism? If not, what terms are more appropriate to designate the needed coincidence of internally constructed knowledge with experiential reality and consensual social discourse. Conceptual meanings are social constructs defined by discourse communities. An individual's conceptual knowledge is useful only if the personal mental construct gives the person the adequate knowledge necessary to make predictions that will coincide with experiential reality. As an individual's perception and construction of knowledge evolves, so scientific paradigms, which contain "concepts" as socially constructed knowledge evolve. The exploration of the nature of representation and symbolism in constructing knowledge and the question of what is real should be a part of constructivist educational pedagogy. In order to bring constructivism into a well defined educational paradigm the careful examination and specific use of terminology must be determined by the discourse community. A discussion of these issues using illustrations will be the focus of this presentation.

INTRODUCTION

A colleague of mine who is always eager to show me a demonstration of physics phenomena wanted me to come see yet another apparatus. Usually, I am pretty eager to see his projects and appreciate his tangible grasp of the physical world. I wish that more women, myself included, were tinkerers like he is. This day, however, I had a lot on my mind and only half willingly followed him to his office. I didn't want to be rude. He started spinning the fan in the semi-dark room and turned on his strobe. Perceptually it appeared that the fan had stopped spinning.

"My high school students always think I've stopped the motion." He said with a grin. He illustrated that it was moving by putting a piece of paper in the

fan. The paper was chopped up by the motion of the blades. I, too, smiled and said I had to get back to work, thinking to myself-- another misconception -- one I was a little surprised that high school students would have. I continued to ponder for a few minutes, trying to imagine the classroom interaction where students would confront and hopefully resolve their misconception with theories of what was happening. Then, I put the thoughts aside and went back to my preoccupation with the conflict I was struggling with in trying to reconcile the nature of reality, radical constructivism and the usage of the term misconception. Late that night, still trying to find a means for expressing my thoughts I remembered the strobe incident. It struck me that if you took a photograph of the phenomena it would be the "misconception" that would appear on film.

DISCUSSION

What is a misconception? In science definitions might include: an incorrect interpretation of the facts; a misunderstanding of a phenomena; a view different from accepted scientific views. It has been found that students have preconceptions which affect their acquisition of accepted scientific views. Students may even cloak their misconceptions in scientific terminology. (Stepans, Beiswenger and Dyche. 1986.)

Other terms come to mind when struggling to describe misconceptions. If students are perception bound, the misconception may really be a "misperception." If a student repeatedly makes correct predictions, but is unable to give a "correct" verbal response, perhaps the problem is not misunderstanding, but misrepresentation. Schema are theoretical mental structures in present cognitive psychology. Is it possible to have a "mis-schematization"? In these attempts at formulation it becomes evident that the root terms concept and conceptualization may need clarification.

A concept in science could be defined as an understanding and interpretation of a phenomena. Having a mental concept allows one to make predictions about experiential reality. Conceptual understanding is evidenced by verbal explanations and mathematical manipulation of equations. Both of these are representational forms of conceptual understanding.

Although the word perception is sometimes used as a view of things, generally

the term concept denotes going beyond sensory perception to interpretive, predictive knowledge and at higher levels to generalized and representational knowledge.

However the terms conceptual understanding and perceptual understanding are interrelated and interactive. There is no natural split between the two. When my daughter was a baby I watched a fascinating effort. She was at the table with us playing with a spoon. She became very intent, looking with extreme concentration as

she transferred the spoon to the other hand. The effort was not in the physical grasping, she had long before mastered that. My interpretation is that she was going beyond perceptual action to deliberate conceptualized action. Although she had, in my view, a conceptual understanding of the process it was at a perceptual level, not representational.

When conceptual knowledge is defined through verbal and symbolic representations of accepted scientific views a concept becomes a term defined by the social discourse of a specific community, rather than an individual construction.

If the individual's "conceptual understanding" is given and constrained by the limits of the social transmission without the physical experience can there be any real understanding? Does a *feel for the phenomena* involve conceptual understanding? It was these kinds of questions and a concern for promoting active learning that led me to constructivist theory and pedagogy in education.

The constructivist movement in education is tied to the paradigmatic shift from behavioristic to cognitivistic views of learning. The emphasis is shifted to organized internal representations. (West, 1991.) The learner is seen as actively constructing knowledge from experience, including social discourse, based on their own prior knowledge and mental schemata, rather than being a "Tabula rasa," a blank slate.

Viewing the learner as a blank slate leads to two precepts which have traditionally dominated education: first that we can impart knowledge by transmission; secondly, according to Bruner (1985, p.6) in this model of the learner, "such order as there is in the mind is a reflection of the order that exists in the world." Accordingly in this paradigm there is a knowable reality, for example viewing science as objective and factual rather than representational theories and procedural. This view of learning is based on the acquisition of knowledge through experience, through the senses, but it excludes the

acknowledgment of the active construction of knowledge by the individual mind, which may lead to perceptual and conceptual differences. In this traditional paradigm it is the teacher who transmits knowledge about the absolute external reality.

Presently educational constructivism is divided into several varieties which include trivial, radical and social constructivisms (Ernest, 1992). In the first type the Newtonian/ absolute space model of the world maintains its traditional place in education. In this case, using the term misconception implies that the person who has the misconception is somehow not understanding the true nature of things. Geddis (1991, p.4) points out that the use of the term misconception reflects the "traditional view of teaching as knowledge transmission" rather than constructivism. He maintains that prior beliefs "can be incorporated into a view of teaching that holds central the concept of knowledge as justified, true belief." His emphasis shifts to the process of knowledge acquisition rather than content acquisition, which is in coherence with the nature of science investigation.

The question then becomes: Can we know reality? Science, psychology and philosophical theories indicate that absolute reality is essentially unknowable. In radical and social constructivism the world view is not absolute. (Ernest, 1992). In radical constructivism the world is essentially unknowable because knowledge is constructed by each individual and the experiential world is perceived through the filters of each individual so true objective reality can never be obtained. Von Glasersfeld (1992, p.2) states there is "no exit from subjectivity" and "it makes no sense to speak of a representation of something that is inherently inaccessible." As each individual is unique, so reality for each individual is at least equally unique.

The construction of knowledge by each individual does not preclude the social realm. The seminal influence of Vygotsky has helped develop social constructivism "The mind can be seen as part of a broader context, the social construction of meaning." (Ernest, 1992, p.7). Can our individual constructs have a social meaning without the ability to convey them as concepts in social discourse? Communal agreement on the language of mathematics gives a discourse community which can function within guidelines that help to ensure coincidence of one individual's constructs with another's.

Crowell (1989 p.60) also discusses the nature of our knowledge about the world when he points out that "the inadequacies of the Cartesian-Newtonian

world view make themselves apparent in education as well as in science.” Barad (1993) uses quantum theory in physics to refute the classical realism notion of objectivity in science: “Since observations involve an indeterminable discontinuous interaction, in principle, there is no unambiguous way to distinguish between the object and the measurement apparatus- no natural Cartesian cut exists. Observations do not tell us about objects as they exist independently of us human beings.” (Barad, 1993,p. 13) . Observer and object categorization have meaning only in specified contexts.

Barad suggests the term “agential realism” (Barad, 1993p. 23) as a useful epistemological term in a feminist examination of the nature of science. Including the notion of agency with reality reminds us that we cannot know absolute truth, but that our understanding of reality comes only from our interactions with our environment and our interpretation of our interactions. Furthermore, the term agential reality with its interactive definition implies accountability. In scientific knowledge then there is responsibility. Rather than viewing science as objective reality for which we are not responsible, Barad suggests that “science is about our interactions within nature, and we must act accordingly.” (1993, p.23). It is important to realize, as Barad states and as her term implies that though there is subjectivity in science, this does not mean that there is no objectivity. There is not a definitive Cartesian split between ourselves and our environment, between ourselves and physical phenomena, between science and social structure. This does not mean that there is no external reality. We can make reproducible measurements. We can develop theories and test them for predictability, but our knowledge is always through the filters of ourselves and our invented measurement apparatus. It is at this point that for me radical constructivism falls back toward other forms and the pedagogues converge toward active, experiential learning with examination of the fit of various theories.

The present theories of constructivism in education, however, seem be focused on knowledge acquisition about the present experiential world, hopes that students will be able to reinvent our discourse communities. Is not constructivism also the key to opening the doors to the future? Knowledge of our world is not static, but emergent, at both the individual and social levels. As our communal scientific understanding has evolved, so to our civilization, including frontiers of knowledge, has been established. Our constructs have not

just been internal representations, but external manifestations. Do we not want our students to become external constructivists as well as internal ones?

And so return to the photograph of the fan. The picture shows the same image that our eyes perceive. The picture is real, our perception is real, but although the image of the motion is stopped, the motion is not stopped. The photograph is paradoxical. Our constructions, internal and external, have enabled us to go beyond our perceptions, even extending our perceptual capabilities so that things that were once not perceivable, only conceptualizable are now knowable in a real world sense. Yet our knowledge is also limited by the same inventions which have expanded it. The technologies of photography and lighting enable us to reproduce an real image that is not a valid representation.

Our knowledge, too may be paradoxical. Von Foerster (1973) proposes a neurological model for constructivism which is analogous to a topological shape which wraps back into itself. What we know cannot be considered separately from how we know, and importantly, what we do:

First there is the realization that knowledge, that is what is "known, cannot be the result of passive receiving but originates as the product of an active subject's activity....We therefore call the activity that builds up knowledge "operating," and it is the operating of that cognitive entity which, as Piaget has so succinctly formulated, organizes its experiential world by organizing itself. (von Glasersfeld, 1985, p.32)

Implications for Teaching.

What then are the implications for education. Do we need a reconstruction of schools or a reformation in thinking? The words teach and educate in English mean to impart knowledge. The essence of their definition is to in some way show or guide, even train children. Indeed many of us are also involved in teacher "training." How do we reconcile the meaning of these words with the emerging pedagogy of constructivism?

I can only answer by asking more questions and hoping that you will puzzle with me. Though my questions are not couched in scientific or mathematical wording, my conception of the world is from the basic processes that these disciplines entail. What then, is the nature of knowledge for each of us? Is this a question that a few must consider, or one that each individual should

have the opportunity to contemplate? Does knowledge come from discipline or experience? from thinking or perceiving? from communication or non-communication? or all of these? Is the nature of our knowledge perceptual or representational and can we separate the meaning of the two? Can those of us who are facilitating “conceptual understanding” and those who are being facilitated use those concepts to create a world of knowledge and justice, of peace and flourishing? Do we want to foster not just understanding and productivity, but creativity both in thought and deed? What are schools for anyway, and how do we empower ourselves to enable children to reach toward those aims?

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