

Humans, intentionality, experience and tools for learning: Some contributions from post-cognitive theories to the use of technology in physics education

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"There is little evidence to show that the mind of modern man is superior to that of the ancients. His tools are incomparably better." (Müller, 1940)

The English word "cognition" stems from Latin "cognoscere" with the meaning "to become acquainted with", "know" and "to come to know". Thus, if we want to follow the meaning stemming from the roots of the word we cannot only study "what happens in the head" if we want to study cognition.

I argue that to study cognition properly we must take an experiential perspective and study human - world relationship. To do this we must study the tools used by humans.

Following Dewey, Peirce and James I argue that cognition is related to capabilities for action and is itself a special kind of action of the human body. This is stated by Rorty (1991) as:

"[we should not] view knowledge as a matter of getting reality right, but as a matter of acquiring habits of action for coping with reality".

In a similar vein Noë (2004) argue that

"perception is not something that happens to us, or in us, [but] something we do"

and Wartofsky (1971/1979) argues that

"the separation of logos from praxis is impossible".

Central in Dewey's (1925) theory of cognition is his principle of continuity stating:

"there is no breach of continuity between operations of inquiry and biological operations and physical operations. 'Continuity' ... means that rational operations grow out of organic activities, without being identical with that from which they emerge".

Pragmatism provides us with a non-dualistic, non-representational model of an embodied mind. Related to this is the importance Dewey saw in seeing acts as dynamic and holistic units. He criticised theories that turned the dynamic process of acting into a sequence of static and disjointed stimuli and responses. The idea of the embodied mind is also important in the work by Merleau-Ponty.

In recent cognitive science there is emergent evidence that the human brain co-evolved with the development of human culture and human use of tools. According to Quartz and Sejnowski (2002)

"the central role of culture in our mental life reveals that intelligence isn't just inside the head. ... Our brains evolved to engage the world ... not to sit around passively".

According to the concept of intentionality stemming from Brentano (1874) we must treat the humans-world correlate as a unity. In line with this view the theories of pragmatism, phenomenology and phenomenography emphasise that there is no detached thinking, seeing, learning etc. Thinking, perception, learning is always related to something.

Nardi & Kaptelinin (2006) have attributed the term "post-cognitivist" to the theories of activity theory, distributed cognition, actor-network theory, and phenomenology. According to them a

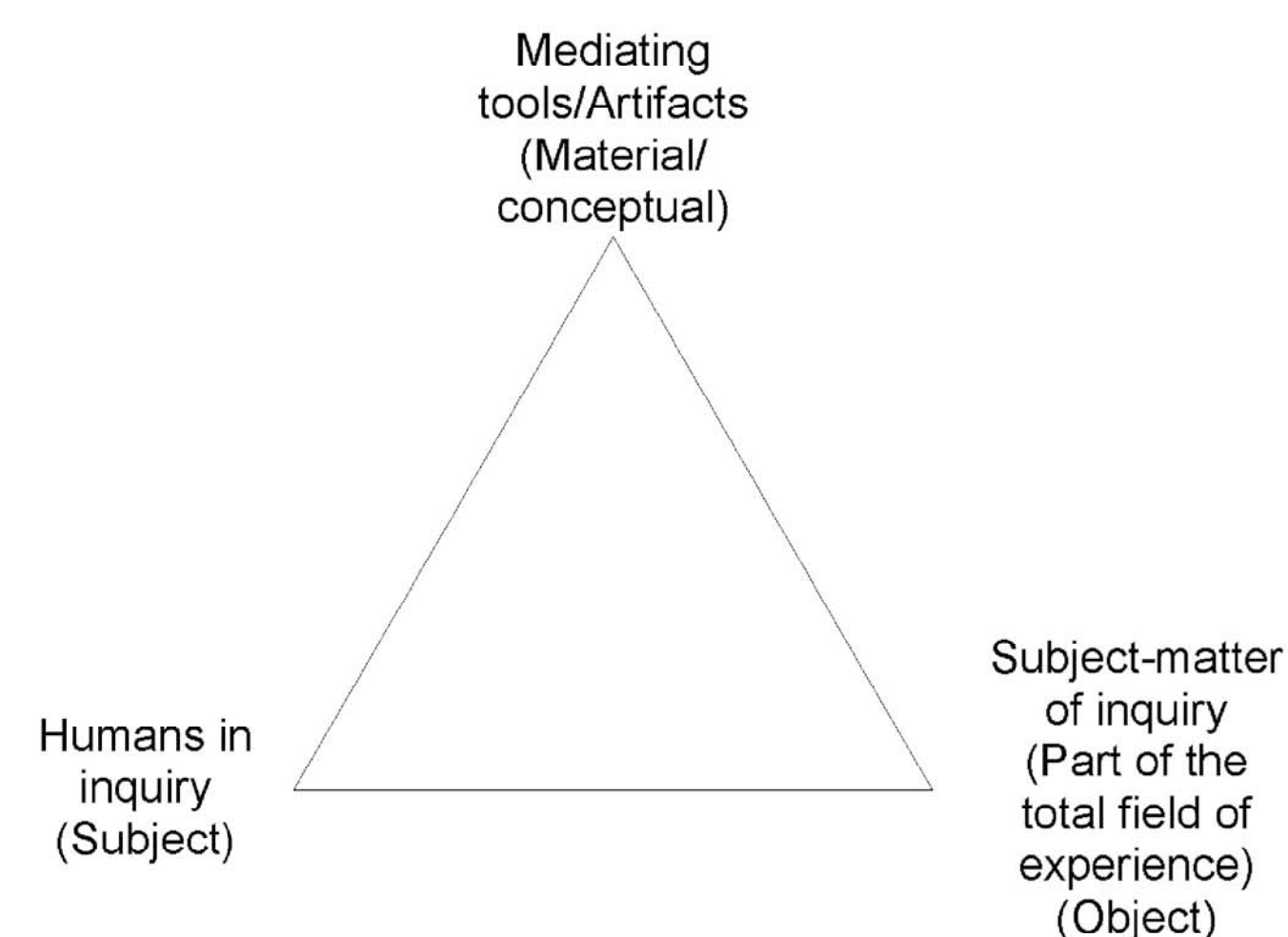


Figure 1. A model showing the concept of mediation adapted and modified from Vygotsky (1978) and Cole (1996): The triadic relationship between subject - mediating tools - object illustrating that the relation is transformed by mediation.

"major point of agreement among postcognitivist theories is the vital role of technology in human life [and that these] theories are highly critical of mind-body dualism".

I claim that pragmatism in the tradition of Dewey is missing is missing in the list of "postcognitive" theories and also the term can give the mistaken impression that these theories post-dated "cognitivism".

The philosopher of technology Don Ihde has made an synthesis of non-foundational phenomenology and pragmatism which has been given the term postphenomenology. In science instruments do not merely "mirror reality" but mutually constitute the reality investigated. Human experience of our world is shaped by physical and symbolic tools (mediating tools).

Human <=> Mediating tools (Technology) <=> World

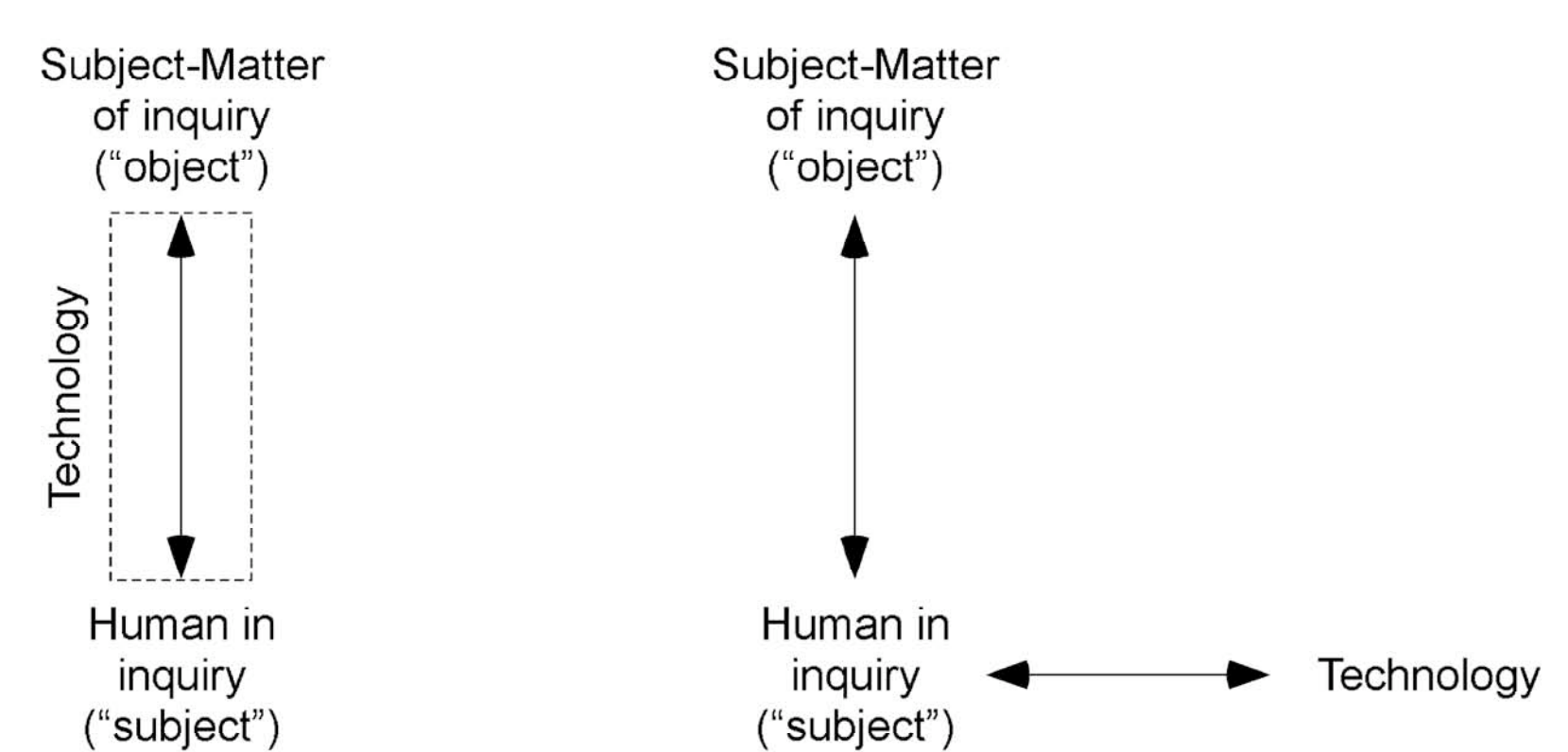


Figure 2. a) A "transmissive" view of technology there technology is seen as only a vehicle for information b) An "Auxiliary" view of technology. The views illustrated represent common views of technology there the relation between humans and their world is mainly unaffected.

Certain aspects are put in the foreground and others in the background by the technology used. It also make certain aspects of reality visible that otherwise would be invisible.

However, in positivist as well as in anti-positivist accounts the technology has been invisible. Neglecting the role of technology in science leads to naïve realism or naïve idealism. I have analysed the role of technology in Microcomputer Based Laboratory (MBL) curricula. I argue if we want to understand the reason for success of some curricula utilising MBL, and not of other, we must do an in-depth analysis of the role of technologies in each case.

To use technologies as learning tools, to their full potential, we must understand their cognitive role(s).

