

## Bridging Cognition and Socioculturalism Within Conceptual Change Research: Unnecessary Foray or Unachievable Feat?

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The articles in this special issue were analyzed in terms of their stance on the nature of knowledge (i.e., its source and location) and the perspective on conceptual change addressed. The analysis supported the argument that efforts to bridge the cognitive and sociocultural orientations toward conceptual change are either unnecessary or unachievable. Specifically, there are those theorists and researchers who do not give credence to the existence of concepts for the one or the collective, and those who do not see sociocultural influences as needed for concept formation or reformation. Attempts to bridge these two positions seem doomed to failure. Conversely, it is argued that the frameworks and models espoused by many researchers, including those contributing to this issue, cannot exist without recognition of the thoughts and reflection of the mind or without consideration of the sociocultural influences that exist in the world outside the mind.

As the guest editor of this special issue so eloquently stated, there is debate and discord in the educational research community as to whether learning and conceptual change is more rightfully perceived through a cognitive or sociocultural lens. Is the process of concept formation and reformation about individual mental representations within domains or a matter of enculturation into a community of practice? To what degree is concept formation and reformation reliant on rational thought or derived from empirical evidence? The goal of this special issue is to recast this debate by asking international scholars to ponder ways around the theoretical and practical issues that have been barriers between cognitivists and socioculturalists engaged in research on conceptual change.

I concur with Mason, the issue guest editor, and with the contributors to this volume, that there would seemingly be theoretical and practical value accrued from reframing ongoing debates about the nature and conditions of knowledge revision and by redirecting the conversation toward shared concerns. However, such efforts at reconciliation are not as simple as they may appear at first blush. It is not merely a matter of joining hands across the rift, which has appeared not only within research on conceptual change, but in the

broader educational literature as well. This is because there are fundamental epistemological and ontological issues at work within the positions espoused in the literature and reflected in the articles herein.

Specifically, it is my contention that this attempt at bridging cognitive and sociocultural approaches to conceptual change represents either an unnecessary foray into theoretical terrain or an unachievable feat of epistemological/ontological reconciliation. Further, whether this bridging attempt falls on the side of unnecessary foray or unachievable feat rests on (a) the cognitive or sociocultural perspective voiced and (b) the manner of conceptual change considered. To support this contention, I will draw on the arguments and insights of the scholars contributing to this provocative issue, as framed within learning theory.

### THE MANY "FUZZY" FACES OF COGNITION AND SOCIOCULTURALISM

The educational literature is populated with an array of theories on learning that have been loosely encapsulated under the labels of cognition or socioculturalism (Alexander, 1996; Bereiter, 1994; Phillips, 1995). Although the use of the more encompassing labels may simplify theoretical discourse, such simplification can have the unintended consequence of

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masking significant epistemological distinctions of relevance to conceptual change research and practice. For instance, when we use the term “cognition” to mark a theoretical stance, are we talking about the approaches associated with radical constructivism (von Glaserfeld, 1991), information-processing theory (Simon, 1989), or cognitive constructivism (Piaget, 1926, 1930)? Similarly, when an approach to learning and teaching is categorized as socio-cultural is one envisioning social constructivism (Vygotsky, 1978), situated cognition or situativity (Greeno, 1989; Greeno & the Middle School Mathematics Through Application Project Group, 1998), or theory more aligned to social or cultural anthropology (Lave, 1988; Lave & Wenger, 1991; Rogoff, 1990)?

All of the aforementioned theories and their innumerable iterations can be differentiated in multiple ways, including epistemologically (i.e., views on the nature and source of knowledge). Further, such epistemological differences make this bonding process seemingly unnecessary or unachievable. I am not alone in my contention that epistemology matters in this cross-perspective dialogue. Several of the authors readily admit that questions about the nature of knowledge are paramount to this hoped-for partnership. For instance, as a frame for her argument, Vosniadou (2007) wrote that the “main difference between the two perspectives [i.e., cognitive and sociocultural] is their position on the ontological status of knowledge” (p. 56). Similarly, Murphy (2007) stated that “sociocultural and cognitive perspectives hold to epistemically different views on knowledge acquisition and change” (p. 41). I could not agree more.

For example, do researchers in conceptual change, as with the philosophers of decades past, assume that knowledge arises solely or primarily through rational thought (i.e., a cognitive construction) or through empiricism aided by social interactions situated within a specific time and place (i.e., a sociocultural construction), or some combination thereof? Moreover, where does knowledge ultimately reside for those in these varied cognitive or sociocultural positions? Is it found in mental structures of the mind (i.e., mental representation or models) or is it nested in the environment or alive only in group interactions (i.e., situated phenomena)? Halldén, Haglund, and Strömdahl (2007) put forward this very fundamental quandary at the conclusion of their article when they stated that “there is the debate whether knowledge is to be looked upon as personal and residing within the individual or if it is embraced within discursive practices and cultural tools” (p. 38).

The intersection of these basic questions about where knowledge comes from and where it resides creates an epistemological space that serves to frame the array of learning theories. For the sake of discussion, I offer a tentative placement of several learning theories within this multidimensional space (see Figure 1), including those related to the programs of research presented in this special issue. Of course, I do so with the understanding that others may

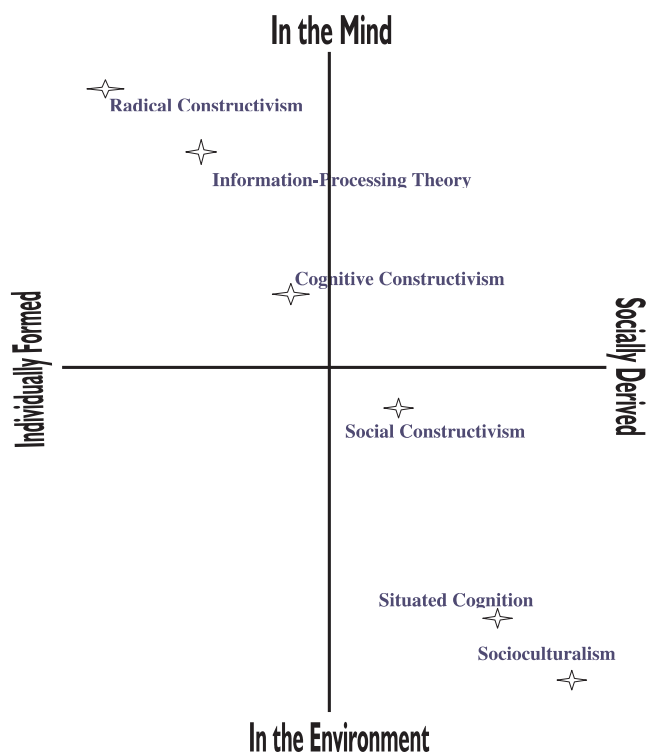


FIGURE 1 The epistemological positioning of learning theories.

well position these theories differently. Nonetheless, within this multidimensional space, we encounter theories that give primacy to the individual mind as both the constructor of knowledge and its repository (e.g., radical constructivism). In contrast, there are those theories that locate both the source and location of knowledge, or more precisely knowing, within the immediate social context and human interactions (e.g., socioculturalism). For the current discussion, I refer to these more extremely positioned learning theories, be they cognitive or sociocultural, as “hard perspectives.”

Between these more extreme epistemological stances, we can position the majority of learning theories and programs of research on conceptual change. Although some of these theoretical orientations lean more heavily on the side of the individual mind, as shown in Figure 1, either in terms of the source or the location of knowledge (e.g., information processing or cognitive constructivism), others tend more toward the social end of the multidimensional space (e.g., social constructivism or situated cognition). It is precisely these leanings that Greeno and van de Sande metaphorically depict when they describe a bridge that could be built more from one side of the riverbank or the other. Regardless of the disproportionate contributions of the builders that bridge would eventually connect the cognitive and sociocultural sides of the epistemological debate. It is this collection of more moderate theories that I place under the category of “soft perspectives.”

## SOFT VERSUS HARD PERSPECTIVES

Why engage in such theoretical sorting and sifting as the framework for the discussion of the articles presented in this special issue? It is to support my argument that those who represent the soft perspectives do not have to build bridges between cognitive and sociocultural orientations. That is because those orientations could not exist without the acknowledgment of the other bank of the river. To extend Greeno and van de Sande's metaphor: A river without two banks ceases to be a river. So, how are we to judge whether the stances toward knowledge taken by the authors in this special issue are indicative of the soft or hard perspective? One way is to subject the ideas forwarded by the contributing authors to critical questions related to conceptualization, sociocultural influences, and truth.

First, we can begin to triangulate these authors' positions by ascertaining whether their perspectives allow for conceptualization at all. If there is no place for the existence of a concept or the formation of concepts in any manner, then there is no reason to even hope for a theoretical bridging. Second, beyond the minimal test of whether there is acceptance of conceptualization, it becomes essential to consider whether there is a "reality" or "truth" to which a person's or group's understanding can be judged. In effect, if all notions are of equal merit and require no further development or justification relative to accepted or validated understandings, then there is no reason to engage in the exploration of conceptual change from either bank of the theoretical river.

Finally, just as it is essential to acknowledge the existence of concepts and levels of truth or accuracy in conceptions to qualify as a soft perspective, it is also requisite to perceive social and cultural forces as influences on understanding, however strong or weak. If thought or the formation of concepts can proceed without consideration of sociocultural forces, then we are again faced with the futility of building a bridge toward the social side of our river.

So, how do our authors stack up on these questions of conceptualization, truth, and sociocultural influences? Do they, in effect, qualify as softer or harder perspectives on the change process, and where would I position them in that epistemological space I previously described. I found the Greeno and van de Sande and the Vosniadou articles to be the most obvious points of contrast on these issues, particularly because they were cast somewhat as epistemological point and counterpoint.

For instance, in the situations they pose and the language they employ, I envision Greeno and van de Sande (2007) standing firmly on the sociocultural side of our river but with a hand metaphorically outstretched toward the cognitive shore. As a case in point, these authors avoid the use of such terms as mind and knowledge and seek to redefine the notion of concepts as perspectival understandings. In fact, "mind" appears only once in their article and in that case the term was used to distinguish the cognitive perspective on conceptual

change from their unique perspective. When mentioned, albeit infrequently, "knowledge" is viewed as *between* rather than *within* individuals, with conceptual understanding and conceptual growth portrayed as functions "accomplished by activity systems and communities of practice" (p. xx). It would appear therefore that conceptualization has a place within Greeno and van de Sande's perspective but only when it comes to the source of knowledge. There appears to be no movement toward the cognitive side of the river when the topic turns to the question of where knowledge resides. Vosniadou voiced similar concern with the Greeno and van de Sande perspective when she argued that "knowledge must be seen not only as a process but also as a product, an object to be taught" (p. 63).

As to the issue of truth or accuracy, Greeno and van de Sande offer support for the need for conceptual growth or understanding, although the idea of a misconception does not arise in their discussion. Specifically, their criterion for any "truth" judgment pertains to "following accepted procedures and terminology with authority vested in the discipline" (p. 12). One is said to act with conceptual agency when a positive contribution is made to that disciplinary group or community of practice. To play off of Murphy's creative title in this issue, truth for Greeno and van de Sande is in the eyes of the beholders. Thus, given the primacy for sociocultural influences, acceptance of a distributed conception, and the collective judgment of truth, I have placed Greeno and van de Sande squarely within the sociocultural quadrant with some drift toward the cognitive side of the proverbial river (see Figure 2).

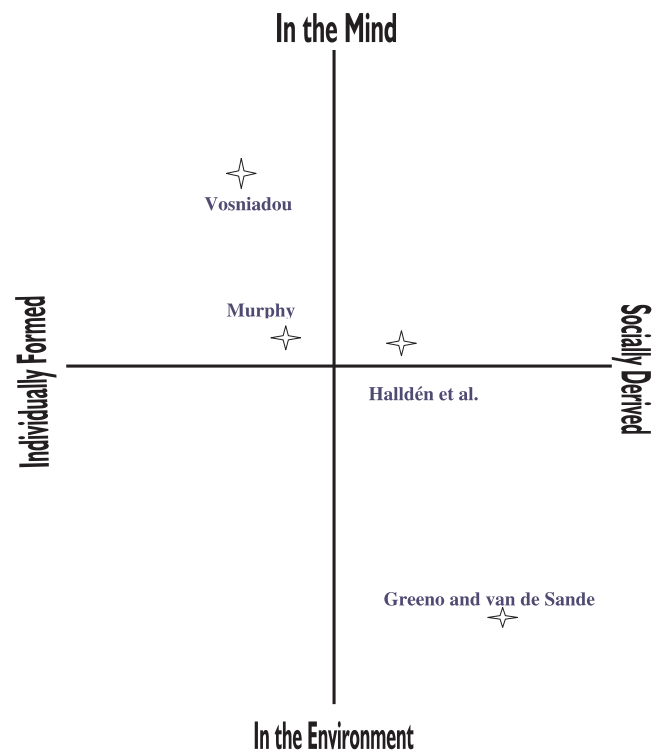


FIGURE 2 Epistemological perspectives of contributing authors.

In contrast, Vosniadou (2007) does not shy away from the idea of concepts or the mind as repository of knowledge; both are essential to her theoretical perspective. Nonetheless, she readily accepts that such concepts are directly affected by sociocultural forces and are therefore not only changing and changeable, but also socially distributed. Quoting Hatano (1994), she concurs that while “understanding is a social process, it also involves much processing by an active individual mind.” The symbolic structures that are essential in the process of conceptual change for Vosniadou can exist internally in the mind of the individual or be found in the context or environment (e.g., globe).

But where does Vosniadou stand on questions of truth or accuracy? As with Greeno and van de Sande, she vests the disciplinary community with much of the power to judge the verisimilitude of individuals’ mental representations. Through orchestrated and positive instructional experiences, students may abandon their more naïve or synthetic mental models for those that more closely approximate accepted scientific models. Thus, based on her detailed explanation, it is not hard to position Vosniadou within the more cognitive quadrant but with clear advances toward the sociocultural side of the river, especially when the question pertains to the source of knowledge.

The other two contributors to this volume can be found more to the center of this multidimensional space, or somewhere in the middle of the river to use Greeno and van de Sande’s metaphor. For Halldén et al. (2007), the mechanism that illuminates the necessity of a dual cognitive-sociocultural perspective on conceptual change arises in attempts to unearth and interpret individuals’ mental representations. As they explain:

Rather than regarding interview data as mirroring some sort of conceptual structure related to the mind, or some sort of mental processing, we look at the answers as indicating what the interviewee is trying to accomplish in the interview situation. Thus, the object of analysis is verbal *actions* rather than utterances regarded as overt representations of thoughts or mental processes. It is by identifying these actions that we can make inferences about the agent’s knowledge and experiences. (pp. 31–32)

The casting of concepts in words that communicate by the interviewee and the efforts to interpret and affix meaning to those utterances by the interviewer is a social act nested in a particular context.

The question of the correctness or accuracy of individuals’ conception is a bit more problematic to assess in Halldén et al.’s contribution. Although there is concern for coherence or correctness, much of that focus rests on the match between the individuals’ true understanding and those extrapolated through the interview process. Nonetheless, it would seem that Halldén et al., as with Greeno and van de Sande, privilege the conceptions or perspectives of the scientific commu-

nity in ascertaining the naïveté or sophistication of conceptualizations. Therefore, I surmise that Halldén et al. locate knowledge or understanding in the mind of the individual but ascribe the process of knowing to sociocultural factors placing them more toward the social constructivism aligned with Vygotsky (1986, 1978).

Finally, Murphy (2007) has forwarded an interesting, albeit complex, model of change that is informed by the philosophical debate between rationalism and empiricism, and that places beliefs as much as knowledge at the foreground of the change process. In this way, both Murphy and Vosniadou have sought to reframe discussion of conceptual change as the process of transforming beliefs as much as knowledge. What seems apparent is that the mind remains the sole repository of knowledge for Murphy, who does not even broach the topic of distributed understanding as does Vosniadou.

Yet, while Murphy seeks to move the consideration of conceptual change deeper into the thoughts and beliefs of the individual, she does so by not only recognizing that there are levels of understanding that must be acknowledged (i.e., knowledge *of*, knowledge *about*, and knowledge *that*), but also by strongly weighing both rational thought and sociocultural experiences as critical catalysts for shifts in knowing and believing. Recognition of these internal representations and rationalizations and the external catalytic experiences are evidenced in her concluding remarks when she writes:

I have urged those interested in change to acknowledge truth as seen through eyes of students and to initiate experiences and conversations that encourage students to expose and justify their own understandings. (p. 51)

Moreover, Murphy sits at the crux of the multidimensional grid in terms of the issue of truth or accuracy. That is because her model accepts that there can be varied paths for justification for students, any of which can lead to justified true beliefs (i.e., knowledge) or prove fallible in that regard.

For the rationalist the source [of knowledge] is innate ideas and reasoning about those thoughts and ideas, and for the empiricist the source is sense experience. Soldiers for both sides claim that *their* source of knowledge leads to accurate understandings about the world (i.e., truths). Yet, there is no conflict when it comes to acknowledging that either path to truth can be precarious or fallible. That is, even if internal reasoning is the source of knowledge, there remains the possibility that one could introduce misconceptions due to problems in reasoning. Similarly, one could be misled by sensations and the perceptions they engender. In essence, for neither approach can we be certain that the ways in which individuals conceptually represent the world actually correspond to the ways the world exists. (p. 42)

Finally, unlike the other authors in this volume Murphy does not seem to privilege domain experts or communities of



practice as the primary source of authentication. Perhaps that arises from the fact that Murphy was the only contributor to the volume who did not focus discussion around scientific domains where empirical evidence holds sway. Thus, when I consider Murphy's espoused views on conceptualization, sociocultural influences, and truth, I place her somewhere between the cognitive constructivists and the social constructivist; that is toward the center of Figure 2.

In summary, looking across the articles in this volume, I find that most can be justifiably cast as relatively soft or more moderate with regard to their epistemological stances on conceptual change rather than hard or more extreme in their viewpoints. That being said, the "soft" label seems more precariously applied to Greeno and van de Sande's perspectival understanding, especially when the dialogue moves away from questions about the source of knowledge to where such knowledge resides. Nonetheless, I hold that even Greeno and van de Sande cannot operate theoretically without some acknowledgment of individual cognition even if it is to subsume that individual mind within a collective or distributed mentality.

### WHAT DOES CONCEPTUAL CHANGE MEAN?

But what about conceptual ontology; that is, what does conceptual change actually mean to these individuals? To what degree are those seeking to build bridges between cognitive and sociocultural perspectives dealing with rather subtle or everyday changes in individuals' or groups' conceptual understanding? Or, is their focus on more drastic and hard to achieve transformations in conceptualization? The question of the nature of conceptual change has significance because it is my contention that it is easier to ford the theoretical river when the waters are rather shallow and calm versus when they are deep and turbulent. In other words, if cognitive or sociocultural researchers restrict their conversations to quieter and less dramatic forms of conceptual change, such as occurs through accretion or even assimilation (weak restructuring), there may be less grounds for conflict than when they venture into more contested terrain such as that aligned with accommodation, especially radical restructuring.

Here again the contrast between the perspectives of Greeno and van de Sande and Vosniadou proves enlightening. As they did in addressing issues of epistemology, Greeno and van de Sande appear to have stayed within safer and more charted waters. That is to say, while their article is replete with cases of conceptual growth, none of their cases expressly manifest more radical forms of conceptual change or expressly address the contentious question of transfer that has riled the waters for cognitivists and socioculturalists in the past (Alexander & Murphy, 1999; Greeno, Smith, & Moore, 1996). For instance, Greeno and van de Sande offer

one case representing individuals' quiet assimilation into a community of practice.

...a group such as a classroom changes so that more of its student members participate productively in its discourse involving a concept or conception, that change counts as a form of conceptual growth by the classroom community as well as by those individuals whose productive participation regarding that concept or conception increased. (p. 12)

They also describe a more involved situation from the research of Stenning, Greeno, Hall, Sommerfeld, and Wiebe (2002) showing that

students who constructed models of population growth and decline developed understanding of predation that enabled them to include it as a factor in a complex model in support of a proposal to solve a hypothetical problem involving predator and prey populations. (p. 13)

Although both instances support their arguments relative to perspectival understanding, they do not address the potential for significant epistemological or ontological shifts on the part of the group or its members.

By comparison, Vosniadou dives headlong into the controversial area of knowledge transfer, even while giving ground to the role of social influences and contextual factors in the change process. Moreover, the process of formulating mental models she describes as part of framework theory embraces both the subtle and more dramatic aspects of the change process. For instance, she describes simple, bottom-up, additive mechanisms akin to accretion as "capable of producing spontaneous developmental conceptual changes, assuming that new knowledge is coming in through observation and/or from the culture" (p. 59). Eventually, the accumulation of those experiences may result in what Vosniadou labels as "branch jumping...or as an ontological shift...and represents a considerable re-organization of the concept of living thing" (p. 59).

Unlike Greeno and van de Sande, Vosniadou is not content to stay within the realm of everyday experiences. Instead, she holds that such everyday encounters can lead to misleading synthetic models that demand more direct and significant interventions. Consequently, Vosniadou argues that "to explain conceptual change, we should allow for the possibility that what is already known can be radically restructured and that new, qualitative different structures emerge" (p. 55).

Like Vosniadou's framework theory, Murphy's model of knowledge/belief change encompasses levels of change ranging from subtle accretion to more radical transformations. Specifically, it would appear that restructuring, especially the radical form, would be possible for those reaching the stage of explanatory power and essential for those who attain examined understanding within any conceptual domain.

Because the focus of Halldén et al.'s article deals more with the methodological gap between cognitivists and socioculturalists, the nature of concepts they would consider is harder to pinpoint. However, if I were to extrapolate from the cases they offer, it would appear that their interests clearly extend beyond the ideas formed through everyday experiences into more scientific understanding, such as gravitational force. Further, their concern in this volume is less on the change that is evidenced in an individual's understanding as it is on actually interpreting the individual's conceptual understanding relative to a given problem posed within a specific context. As Halldén et al. write:

It is very difficult, if not almost impossible, to ascertain what knowledge an individual *does not* possess; a seeming lack of knowledge can always be an artifact of the kind of questions we are asking or of the way we are arranging the setting of a test....However, what can be done and what we have done here is to describe the knowledge utilized by an individual when trying to solve an identified problem or to maintain a project in a specific situation. (p. 37, emphasis in original)

### CONFLICT RESOLUTION?

At the outset of this commentary, I argued that the effort to bridge cognitive and sociocultural perspectives on conceptual change, however laudable in theory, represents either an unnecessary foray *or* an unachievable feat. Which of those two situations applies for the contributors of the present issue? Do the perspectives on knowledge those contributors forward and the nature of conceptual change they address require recognition of the views of those standing on the opposite bank of the theoretical river, no matter how slight or reluctantly offered? Or, are the epistemological stances so far out in multidimensional space and the mechanisms of change so radical that those hoping to bridge the differences have no grounds upon which to base their constructions?

What I found in the critical analysis of these thought-provoking articles is that even those researchers more firmly ensconced in the realm of cognition or socioculturalism were unable to forward their theoretical frameworks or models without acknowledging the power of thought and reflection or the influence of the physical world. To draw on Murphy's philosophical discussion, these frameworks or models could not exist without the interplay of rationalism and empiricism? Nowhere was this interplay more apparent than in the contrast between Greeno and van de Sande's perspectival understanding and Vosniadou's framework theory. The differences between these two orientations toward knowledge and conceptual change (or growth as Greeno and van de Sande prefer) cannot obscure the fact that the mental models described reflect the world outside the mind and that the understandings that groups construct can-

not arise without thought and reflection on the part of individual members.

The fact that efforts to bridge cognitive and sociocultural perspectives may be unnecessary for these contributing authors does not diminish the value of continued dialogue between those who populate different epistemological quadrants. Rather, Mason is to be applauded for bringing together researchers holding varied orientations toward knowledge and conceptual change and for provoking discourse among them. Even if the bridging of cognitive and sociocultural perspectives comes naturally or reluctantly to the current authors, it remains a seeming impossibility for those who keep thinking solely within the confines of one's mind or for those whose world does not allow for conceptualization, truth, or mind. Whether individuals are willing or able to explore theoretical grounds other than their own, they have at least been afforded a glimpse of the river.

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