Introducing Critical Constructivism

Panelist 1: Critical Consciousness Through A Critical Constructivist Pedagogy

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> Curriculum, research methods, pedagogy: all are much contested cultural terrain. Current directions in American culture are full of contradictory voices. …We live in both/and worlds full of paradoxes and uncertainty where close inspection turns unities into multiplicities, clarities into ambiguities, univocal simplicities into polyvocal complexities. (Lather, 1991, p. xvi)

Joining me to form this panel are my colleagues Drs. Jim Garrison, Professor of Philosophy of Education at Virginia Tech, and Steve Fleury, Professor of Education at LeMoyne College in New York. Our interest is in theoretical, empirical and pedagogical developments in science and social studies education related to *critical constructivism*. Described previously in *Constructivism and Education* (Larochelle, Bednarz & Garrison, 1998), critical constructivism refers to a theoretical stance in education related to developing in students an understanding and disposition about knowledge that furthers democratic living. Critical constructivism is not just one more way to address and achieve the ends that are valued

in the dominant educational reform movement. We concur with Elliot Eisner (2003) in that, "the function of schools is surely not primarily to enable students to do well on tests, or even to do well in school itself." (p. 651) Rather the purpose of critical constructivism is to bring about a greater personal and social consciousness in our students and "to enable students to become the architects of their own education so that they can invent themselves during the course of their lives." (Eisner, 2003, 652)

Toward these broad aims, my colleagues and I are particularly interested in K-12 science and social studies education. Today we focus on ideas that have implications for teaching and learning in these subjects. One such idea is the relationship between how one knows and how one lives in the world; a second is that knowledge is contingent; and a third is that all human knowledge is value-laden, i.e., culturally and politically responsive.

We advocate a critical constructivist pedagogy that enables students to shape and reshape their own "conceptual biographies" through the development of intellectual tools and attitudes about the social basis of knowledge, a pedagogy that enables students to better understand society's "official knowledge" as it relates to their own indigenous knowledge, thus developing a new "rapport au savoir" (a relationship with knowledge), understood as a "relation of meaning, and thus of value, between an individual (or a group) and the processes or product to knowledge production" (Charlot, Bautier, & Rochex, 1992, p. 29)**.** Further, the *rapport* to scientific knowledge constructed by students has much to do with the production and reproduction of social power structures in society. The critical awareness that accompanies this new relationship with knowledge is intellectually liberating but also fosters ethical sensitivity, leading students to become more "response-able" for democracy.

Panelists today will expand the notion of critical constructivism and provide additional examples of how a critical constructivist approach is employed in everyday classroom practices to enhance student mindfulness and critical consciousness. Our focus is not so much about particular techniques of teaching, but rather a foundational understanding about how students construct knowledge and a positive attitude toward modifying classroom practices to encourage this type of thinking by students.

A Conversation over the Years

As the first panelist today, I begin with a brief history of our joint collaboration on this project. My own field is science education. I have taught science as a high school biology teacher but also at the middle school and elementary levels. Jim is a philosopher of education who has a particular expertise on the thought of John Dewey. Steve is a social studies educator who has had a long interest in the social studies of science. Teacher education is one part of our work, in Tennessee, Virginia, and New York respectively.

The three of us first met at the First International Conference on the History and Philosophy of Science in Science Teaching held at Florida State University in 1989. At that meeting Jim and I presented a paper entitled: "Pre-conceptual and non-rational aspects of cognitive change in science learning." In this paper we challenged premises of the conceptual change teaching model, at that time the leading pedagogy in science education, by calling attention to aspects of cognition overlooked by Posner, Hewson, and other advocates of this classroom teaching method. Steve was also at that meeting presenting a paper titled, "Students as Peasants: The Powerlessness of School Science." He and I had in common that we were fathers of young children at that time. At this meeting we also met Canadian science educators Jacques Désautels and Marie Larochelle of the Université Laval. At the second HPSST conference in Kingston in 1992 Steve and I presented a paper entitled, "Creeping Relativism and Ambiguity as Characteristics of the Contemporary Nature of Science Conception among Students and Teachers" At that meeting we had the pleasure of meeting and dining with Ernst von Glasersfeld, the prominent radical constructivist. In the early 90s we presented together at the National Council for the Social Studies in Chicago, and in 1995 the five us gathered to do a student seminar for the Center for Urban Education at SUNY, Oswego. At this gathering we began to conceptualize the book, *Constructivism in Education* (Larochelle, Bednarz & Garrison, 1998). In 1996 we did a panel session, "Social Constructivism and the Contextualizing of a Social Issues Pedagogy" at an NCSS conference in Washington, DC. The three of us also presented together at AETS conferences in Charleston, SC and Nashville, TN, joined by Larochelle and Désautels in Charleston. At the 5th HPSST conference in Como, Italy in 1999 we presented "Critical-Constructivism, Science Education, and Teachers' Epistemological Development." Further, Steve and I have presented together several times at other forums over the years.

The common thread in all our work is that education is a sociopolitical endeavor and teaching is an ethical act. Every day, in the planning and enacting of the classroom curriculum, the teacher is faced with moral, social, and political questions. One of the most fundamental of such questions involves whether or not to let students in on the knowledge game itself. But, in order to even ask this question, the teacher must have the opportunity herself to learn how knowledge is multiply constructed in multiple ways. Borrowing Schwartz's (1990) phrase (who borrows it from Toni Morrison), the teacher is the leverage point for making students "response-able" (p. 397).

The many forms of constructivism

The idea that we build or *construct* our meanings is the source of the label *constructivism*. Educators have been discussing constructivism for decades now and the term is now recognized by most classroom teachers, but may be understood only at a trivial level. To scholars, constructivism is an *epistemology,* a theory of knowledge, and epistemology, as Schubert (1986) noted, is the branch of philosophy that is most relevant to educators. As a form of pragmatism, constructivism centers on how people “develop narratives and explanations which enable them not only to operate viably in their everyday lives, but also to participate in the habits and customs of the group they are members of” (Larochelle, 1999, p. 6).

The meanings constructed early in life influence later interpretations, and thus a child's prior knowledge influences her science learning (Ausubel, 1968). As Michael Watts (1991) puts it, "We come to understand things in terms of what we already understand; if we cannot lock new ideas into the ideas we have already generated, then new experiences become somewhat meaningless" (p. 54). Thus, in relation to learning, one's prior knowledge can be as obstructive as it can be facilitative (Osborne & Freyberg, 1985; Driver, 1988). The literature is full of studies of children’s naive science - their misconceptions or alternative conceptions, some of which may be robust and resistant to change through instruction, while others may be relatively amenable to change (Watts, 1991). As knowledge is constructed, initial understandings may be fragmentary and incoherent (diSessa, 1988). Conceptual coherence may proceed in leaps of insight as information is assimilated into a framework. Thus cognitive development is stimulated by reflection and inquiry. An insight or the resolution of a conflict

can lead to a completely reorganized "conceptual world" (for both individuals and for scientists in their communities of researchers).

Many scholars from a variety of disciplines have contributed to constructivist literature. As a biologist, constructivism appealed to me through its compatibility with neuroscience research on brain functioning. Educational implications of constructivism, however, are derived largely from the work of Piaget and Vygotsky. Lev Vygotsky (1978), the seminal theorist for social constructivism, recognized that while both biological and social forces play a role in knowledge building, learning is essentially an interactive, social process that involves the use of language (Howe & Jones, 1993, 50). In the social constructivist view, community has priority over the individual and individual rationality is considered a by-product of communication and social life. The social plane is primary and meaning is first sociocultural, "to be internalized by the subject's regulation within discursive practices." (Lerman, 1996, p. 147)

Thus a number of more specific forms of constructivism with different emphases have emerged and constructivism today means much more than simply saying we construct our meanings. The meanings we construct have an adaptive function, helping us make sense of our experience and orient our behaviors and actions (M. Larochelle, 1996, personal communication). Critical-constructivism, a form of social constructivism, emphasizes the social and political consequences of reifying and decontextualizing knowledge. Critical-constructivists acknowledge the social nature of all knowledge construction and therefore value the cultivation of critical communities of inquiry and the achievement of a democratic social order. Critical-constructivists are interested in illuminating all aspects of the production, justification, and ownership of knowledge in society, and in particular, scientific knowledge.

Critical-constructivists also are pluralists. Epistemological pluralism relates to multiplying perspectives. A critical constructivist pedagogy does not rank forms of knowledge, but rather promotes a pluralistic epistemological democracy which favors the enrichment of the field of possibilities for students through their participation in different knowledge games. "The role of pedagogy is to develop an epistemology of pluralism that provides access [to social power] without people having to erase or leave behind different subjectivities. This has to be the basis of a new norm" (The New London Group, 1996, p.72). It follows that warrant and backing must always be provided for the claims made from any perspective.

Epistemological and ontological *response-ability* is the central task of critical-constructivism. To address that task, critical constructivism calls into question three "idols of thinking" prevalent in today's standards-based educational reform, and also very prevalent in teacher education and curriculum and instruction in general (Popkewitz, 1991; Désautels, Garrison, & Fleury, 1998):

(1) *Reification*: presenting contingent and mutable socially constructed forms of knowledge as necessary and unalterable.

(2) *Decontextualization*: reformulating knowledge such that the complexities and contingencies of the social practices that produced the knowledge are concealed.

(3) *Technocratization*: knowledge employed to service bureaucratization and/or scientism, not the sciences-in-action.

Decontextualized, reified, or technocratized knowledge is regulated and distributed in ways that hide issues of power and control circulating in all forms of knowledge, as Foucault has emphasized (1975). There are a number of pedagogical, social, and political consequences of reification, decontextualization, and technocratization (Roth & McGinn, 1998). The work expectations for teachers are all too commonly centered upon the (illusory) transmission of knowledge. A child's education in science can be negatively affected if his or her curriculum is dominated by and organized around reified and decontextualized categories of scientific knowledge. For example, the treatment of subject matter in science textbooks often conceals rather than illuminates socio-epistemological processes of backing and warranting knowledge claims as well as the processes by which they have been standardized. In countering these pitfalls, we contend that critical constructivism can have a potential emancipatory effect in education.

What is important for the improvement of schooling, as Eisner (1995) emphasized, is "paying attention to the importance of building a culture of schooling that is genuinely intellectual in character, that values questions and ideas at least as much as getting right answers" (p. 764), or, as we prefer, as getting *standardized* answers, according to the expression of Fourez (1997). We contend that student learning can be facilitated such that emancipatory possibilities emerge. Further, teacher education, which now emphasizes classroom technique, can be vitalized through systematic reflection and critique. Without reflection, the contingent nature of knowledge remains invisible and the language of teaching

separates content from method, feelings from thoughts, objectivity from subjectivity, teaching from learning, and, ultimately, teachers from students.

Pedagogy informed by critical constructivism

A variety of teaching methods and strategies can be employed to address the need that we identify here, but first a caveat: no straightforward recipe for teaching practice is possible. As Bettencourt (1993) points out, "Practice is never a simple application of general rules to concrete situations... Practice and theory, like knowledge and experience, stand in a relation of mutual adaptation, of mutual questioning, and of mutual illumination" (pp. 47-48).

In my field of science education, the most popular and widespread interpretation of constructivism for practice has been the "conceptual change" teaching model, which interprets learning as a process of deconstructing misconceptions and reconstructing scientific conceptions in their place (Osborne & Freyberg, 1985; Posner, Strike). Jim Garrison and I have criticized this view (Garrison & Bentley, 1989, 1990): taking account of what the student already knows goes beyond the narrowly instrumental goals associated with the conceptual change approaches to learning. Academic knowledge is just one instrument that can help students emancipate themselves from their own biographies. Swartz (1996) for example, illustrates the emancipatory possibilities for social studies teachers by attending to the accuracy of historical information, inclusion of indigenous voices, and promotion of critical-thinking. Larochelle (1996, personal communication) rejects the conceptual change model because it puts teachers in the position of seeking to colonize children's minds with scientists' concepts. Critical constructivists recognize the ethical necessity of applying the *principle of epistemological symmetry*, such that they consider the knowledge developed by students in the context of their local culture as viable and genuine.

Nevertheless, there are pedagogical practices that are compatible with our epistemological stance of critical constructivism. In the social studies, an "issue-centered" approach has been recommended as an alternative to traditional curriculum and instruction (Engle & Ochoa, 1988). Carter (1991) encourages more use of the problem-posing education of Paulo Freire (1989). In the latter, students undertake a study of both personal and social values, beliefs, and assumptions involved in an issue, so that they come to see the world less as

a given and more "a reality in the process of transformation" (Freire, 1989, p. 71, cited in Carter, p. 278).

In the past decade inquiry learning (NRC, 1996) and "problem-based learning" (PBL) have become major trends in science and mathematics education. Inductivist pedagogies such as these are student-centered and support meaning making. PBL emphasizes using authentic problems across the curriculum at all levels (Bridges & Hallinger, 1995), but, like inquiry, does not specifically focus on raising students' social consciousness.

The "STS" (Science, Technology, Society) approach, however, which has become prominent in both science and social studies education, is centered on issues and decision-making that does have a major social consciousness component (Thirunarayanan, 1992).

Critical Constructivism in my UT classes

I teach both undergraduate preservice "methods of teaching science" classes and graduate classes in science education. Most of my grad students are teachers, and, unfortunately, teachers themselves are immersed in the technocratic rationality of schooling with its reified constructs about student learning, academic content, and school organization. An inert, non-problematic image of formal knowledge has been learned through taxonomies, discrete codifications, and implicit and explicit hierarchical organizational forms. The educational experience of teachers has been a continual process of repeated instances of reification and normalization of the contingent categories making up school knowledge.

I directly address this situation in several ways in my SciEd 572 class, "The Nature of Mathematics and Science (in) Education." I open the first class with the Cube Investigation in *Teaching About Evolution and the Nature of Science* (Working Group on Teaching Evolution, 1998). We discuss how solving the cube problem is and is not like the nature of science and they have a homework assignment to create their own cube puzzle. In the next session they take a "pre-test" in which they disclose many of their assumptions about science. This semester, for example, all eight of my students believed that the step-wise "scientific method" is actually the way scientists do science. Many appear shocked when this assumption is questioned. During that second class I also show them a series of slides of optical illusions, making the point that the human brain does not represent reality, but rather *interprets* sense

impressions. That class concludes with the point that meaning is assigned rather than being inherent in external phenomena.

From there the students are assigned readings in one of two course texts (Chalmers, 1999). Chalmers discusses optical illusions too, and then the problem of induction as a basis for science. During the third class I share with research results on adolescent beliefs about the nature of science (typically similar to their own). By this time the students are in disequilibrium. In the next classes they read about falsificationism and the ideas of Kuhn, Lakotas, Feyerabend, and others. Meanwhile they work in teams to conduct interviews of scientists and students on their beliefs about the nature of science. Not surprisingly, they find that most scientists have naïve views about the nature of science, as do the students. These teachers now realize that already they have learned more about the nature of science than what many scientists themselves know, and somehow this is empowering – I note a big change in attitude. Another assignment in this class is for small groups to produce a two-week series of lesson plans focusing on particular content in the state or national standards at a middle or high school level, in which the nature of science is also addressed.

In my science methods classes for preservice teachers, I want my students to realize that their positionalities affect their epistemologies. As their first class assignment I have these students write critical autobiographies (Moscovici, Nichols, Habib, Tippins, & Sullivan, 1994) focusing on the socio-cultural aspects of their own science learning, in and outside of school (see Appendix). Such an assignment has the potential for helping them to become more aware that learning, which they usually understand as a strictly personal or psychological affair, is inevitably a social experience, as knowledge is never constructed in isolation. I am amazed year after year when the majority of my white, middle class students report that socio-cultural factors have had no influence on their own theorizing about education. Another methods course assignment with similar consciousness-raising potential is to have students keep a reflective journal (Koch, 1999).

Further, I discuss with my students how the language of teaching is imbued with metaphors that separate content from method, feelings from thoughts, objectivity from subjectivity, teaching from learning, and ultimately, teachers from students. Regarding the possibilities for "reinventing teaching," Meier (1992) suggests that conditions need to be created for teachers to change how they view teaching and learning, to develop new practices

consistent with these new understandings, and to develop collegial work habits to replace the overly private and individualistic work culture which presently defines their activities. She places the onus of making these structural changes on the teachers themselves: "Teachers must lead the way to their own liberation" (p. 599). To us this means that teachers must be able to both deconstruct and reconstruct the contingent categories that have been continually reified through their educational biography.

Critical Constructivism at Community High

Finally I want to mention a high school curriculum project in which I have had a leadership role that exemplifies, I believe, critical constructivism in action. Community High School of Roanoke, Virginia was planned over a two year period and is now in its second year. It is a "museum school" in that students are involved in projects and investigations involving the cultural institutions and social service agencies of the local community. The school director and teachers were selected on the basis of their own socio-cultural awareness and for their interest in promoting critical consciousness in the student body. The science course designed for the first year's class had a strong history and philosophy of science component. The deconstruction and reconstruction of premises is a strong component of all courses at this school. The results thus far have been encouraging and student retention the second year was very high, with only one student of the first class not returning. A second class was added this year and by the fourth year there should be a full student body of 60 students. The new school is located in the center of the city, in the midst of the local cultural and political action. To learn more about this educational experiment, visit the CHS website at www.communityhigh.net.

Conclusion

Today, constructivism has become the "in" foundational theory for curriculum and instruction, but there are many constructivisms and the trivial version – simply that meanings are constructed, is most widespread. The constructivism we advocate here places its emphasis on social consciousness and democratic citizenship. Critical-constructivism should be a central theoretical referent for science and social studies educators and science and social studies teacher educators. In preservice education, critical-constructivism has to be put at the center of

discussions about the nature of learning, teaching, content, and schooling as a sociopolitical process. Without this kind of experience, potential teachers rarely become perplexed by socio-epistemological considerations or are made aware of their political consequences.

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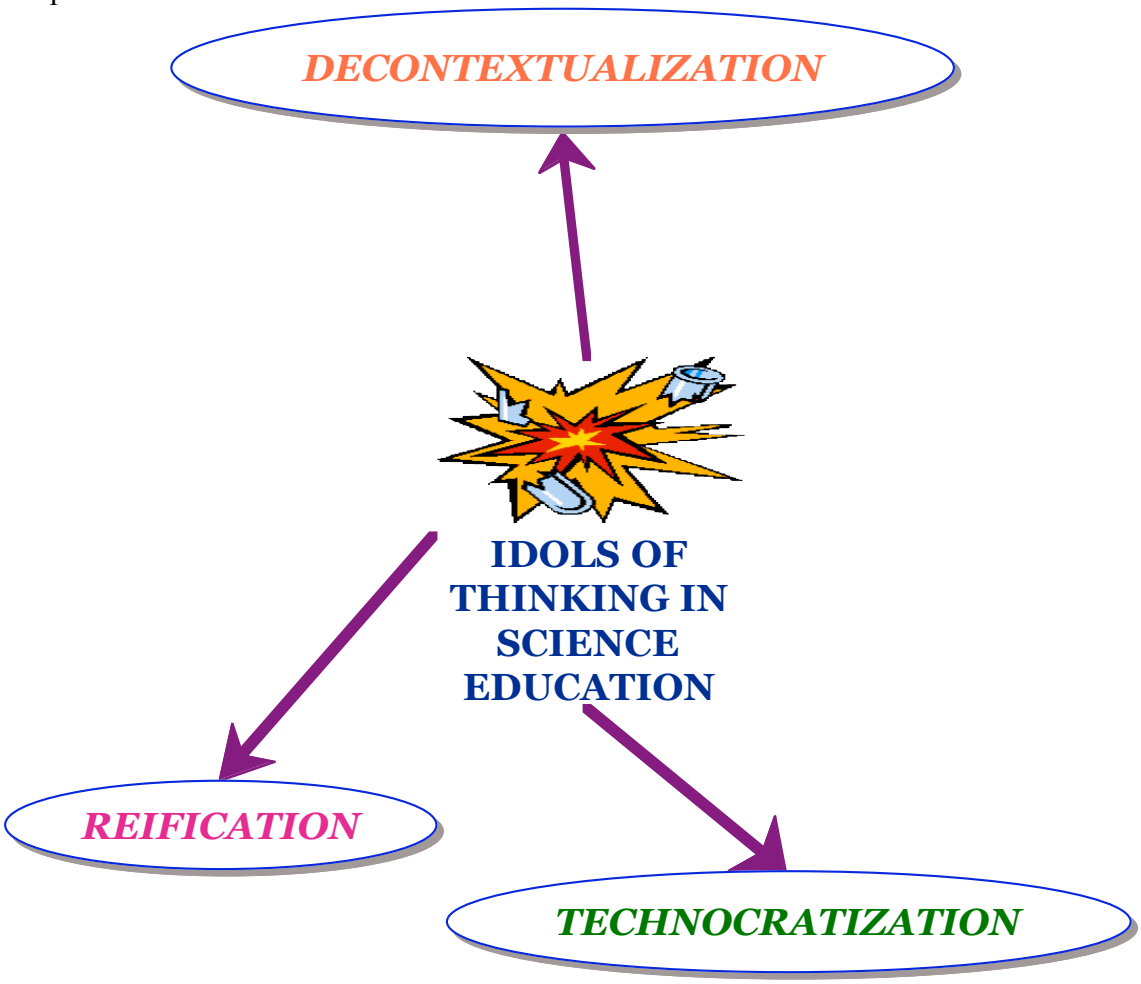
Appendix 1
Graphic– the 3 Offenses



1999, Michael Bentley, adapted from Garrison, J., Desautels, J., & Fleury, S.C. (1996). A critcal-constructivsit manifesto. Paper presented at the International HPSST Conference, Calgary, Canada, p. 5.

Appendix 2

Student Assignment in ElEd 422: Methods for Teaching Elementary Science

Critical Autobiography Assignment

Introduction. The purpose of this assignment is to help you reflect on your school experiences and what you believe about teaching and learning -- for you to explore links between events and people in your life and your personal curriculum theories and philosophy of education. Learning is simultaneously a personal and social experience. While we construct our own knowledge, this is never in isolation, as we are constantly embedded in society and culture. Sketching the 'Road Map' will help you recall your experiences and develop a 'critical autobiography.' The term 'critical' plays an important part in the reflective process as it is important to acknowledge that one's beliefs and values are influenced by one's socio-cultural surroundings.

The task. Begin by designing a '*Road Map*' -- a life timeline -- that illustrates your prior learning experiences and the individuals and institutions that have most shaped your development. Start with the earliest events and/or people that you can recall, then map out your years as a learner in and outside of school, with special attention to the elementary and middle school years (grades K-8). Use the Road Map as a visual aid as you write a more descriptive account of selected events and activities in your life and about the influences of family, peers and teachers which you deem to be significant to the development of your present beliefs about what should be the nature of elementary science education. Design your Road Map and organize your autobiography as you feel appropriate; include both the graphic and written components.

The process. As you examine your Road Map, think about how your present beliefs and practices as a teacher and learner are rooted in the experiences that you have identified. Consider how your thoughts and actions are embedded in socio-cultural beliefs and narratives. Ask yourself, for example, if your gender, religious affiliation, or ethnicity somehow influenced how you were involved as a child in specific learning experiences? Would you have preferred that things had gone differently for you? If so, how?

Writing a critical autobiography involves stating your philosophy of teaching science, which includes revealing your preferred teaching and learning practices. Review your Road Map and autobiography and connect the significant formative experiences and personal affiliations to your present stance on how *you* will enact your own classroom science program.

Learning advice. In looking critically at your background, think about the various sociocultural *lenses* you wear as you look at schools and classrooms, as well as at others (students, fellow teachers, school administrators, school patrons, people of different ethnic and cultural origins, etc., and even other creatures, e.g. wildlife). In thinking about your personal educational philosophy/theories, ask yourself, for example, what you most value in learning outcomes; ask what you believe characterizes *quality* in a science program and science instruction in the elementary school. What do you see when you visualize such a program in action?