FCL and Knowledge Building: A Continuing Dialogue

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Contemporary educational approaches, especially those informed by the learning sciences, almost all pursue twin goals of uncertain compatibility. One goal is to insure students' grasp of important ideas. The other is to help them develop as autonomous learners and thinkers. Some approaches may be biased toward the first goal, others toward the second, but generally there is a tension, which may be alleviated by compromise, wishful thinking, or other more adventurous approaches. Ann Brown and Joe Campione clearly opted for an adventurous, inventive approach, aimed at making the goals mutually supportive rather than competitive. FCL (Fostering Communities of Learners) orchestrates an educational process that is focused on the grasping of big, powerful ideas, but that gives students a remarkable degree of responsibility in working with those ideas. We, too, at about the same time, embarked on an approach, "Knowledge Building," that focuses on big ideas and gives students a high degree of agency in working with those ideas. Yet the two approaches have differences that we believe illuminate

important distinctions within the large family of social-constructivist approaches in education.

Some commentators have treated FCL and Knowledge Building as conceptually the same, differing only in implementation. That there is compatibility we have no doubt. This was the basis for efforts to join the two approaches in Schools for Thought (Lamon, Secules, Petrosino, Hackett, Bransford, & Goldman, 1996) and to this day it is the basis for collaboration between Joe Campione and the two of us as part of the Open Court Reading author team working to develop ways that our shared ideas about inquiry can be realized within the constraints of a basal reading program. But experience in Schools for Thought made limits on compatibility evident, and subsequent discussions, mainly between Ann and Marlene, began to reveal deep conceptual differences. In this chapter we want to explore these differences further. It seems to us that this kind of exploration of differences between near neighbors is essential if educational thought about pedagogy is to progress. As it is, pedagogical innovators of a constructivist persuasion tend to explain their approach by contrasting it with a stereotypic traditional approach, currently labeled "transmissionist." Although this may win approving nods from true and partial believers, it obscures and trivializes differences among innovative approaches and thus degrades dialogue.

Experiences in Schools for Thought provided impetus for a search of similarities and differences between FCL and Knowledge Building. Teachers who were new to both FCL and Knowledge Building had little difficulty combining them procedurally. Teachers experienced in FCL or Knowledge Building, however, rather strongly resisted adopting practices of the other approach. Furthermore, the procedural integration achieved by the newcomers seemed to miss the essence of both approaches. But what was this essence—or were there two essences, sufficiently different to make genuine integration impossible? Conversations with Ann often revolved around inklings, intuitions, and laughter; we could not ourselves understand the difficulties we faced in melding our approaches. The discussions were working their way toward an explanation. Ann's death abruptly halted the discussions, but the impetus remained. The explanation we offer here is one she might well have rejected but would in any case have pushed toward greater clarity. It represents our best effort to clarify a distinction that has proved difficult for us to understand, let alone get across to people in education. The distinction is between learning and knowledge building. FCL, we shall argue, is a powerful learning model but a knowledge building model is fundamentally different.

Distinguishing Knowledge Building from Learning

When we talk about this distinction to educators, most of them assume we are talking about "good" (i.e., constructivist) learning, which we have for some obscure reason chosen to call "knowledge building," versus "bad" (i.e., transmissionist or perhaps rote) learning. That moth-eaten distinction is not the one we are making at all. The distinction between learning and knowledge building is easier to see when we move outside an educational context. Out in the world of what Peter Drucker termed "knowledge work," many people are engaged in producing new knowledge. Their products may be scholarly things like theories, histories, and proofs or more practical things like designs, inventions, and plans. The common element is that these products constitute new or improved ideas that the community can use in producing more new or improved ideas. This continuing process of idea creation, development, and improvement is what we call "knowledge building." In the process of knowledge building, the knowledge workers naturally learn, and such learning is essential to their careers as knowledge builders, but learning is not what they are getting paid for. It is not their job. Their job is knowledge building.

The reason this distinction becomes less obvious in an educational context is that the students' ostensible job *is* learning. But the distinction between knowledge building and learning is just as applicable in schools as anywhere else; it is only that the priorities are different. In schools, learning is what students

typically get rewarded for with grades and diplomas, and any knowledge building they may do along the way is incidental. But imagine a school in which students conceive their job to be knowledge building. Learning, of course, goes on as it does in real-world knowledge building, and it is essential from the standpoint of individual careers, but the *main work* of the classroom community is the production of new and improved ideas. If you can imagine that, then you are imagining a Knowledge Building classroom.

Such a vision might immediately be rejected as unrealistic on a number of grounds. What chance does it have in a society obsessed, from the president on down, with individual learning achievement? Can students actually produce new knowledge or can they only play-act the process? And if learning is incidental to the students' own knowledge-creating efforts, how can we ensure that they will learn the right things and acquire valid knowledge—and do so at a rate sufficient to match the fast-paced learning agenda set by curriculum guidelines? These are legitimate questions that we have responded to elsewhere (e.g., Bereiter, 2002a; Scardamalia, 2002), but it is not our purpose here to build a case for Knowledge Building as an educational approach. Our purpose, rather, is to use the distinction between learning and knowledge building as way to highlight important differences that

exist largely unnoticed within the large family of constructivist approaches in education.

Comparison of Main Features of Classroom Practice

To see how the distinction between knowledge building and learning plays out in classroom practice, let us first survey observable differences between FCL and Knowledge Building and then consider what lies behind them. There is an overall impression of activities in FCL being more highly structured. As Ann and Joe expressed it, the "repetitive, indeed, ritualistic nature" of FCL activities is "an essential aspect of the classroom" (Brown & Campione, 1994, p. 236). More specific differences show up, however, in every aspect of the curricular process. The following are salient examples:

1. Targeted knowledge. In both FCL and Knowledge Building, a broad area of inquiry is set , usually reflecting official standards or guidelines (e.g., endangered species, how airplanes fly, light). Differences appear, however, at the level of more specific objectives. In FCL, the "theme," as it is called, is divided into subtopics. "Students form separate research groups, each assigned responsibility for one of the five or so topics" (Brown & Campione, 1994, p. 233). These shape all the activities that follow. In Knowledge Building, mandated objectives are presented as information at some point during inquiry

in an area. The recommended treatment is to display them in a Knowledge Forum view and encourage students to create links between their notes and relevant objectives. The contents are reviewed and the students discuss whether they have achieved the objectives, whether some have been neglected and need further research, and whether the class has achieved knowledge advances that go beyond the stated objectives. Interestingly, many teachers prefer to wait until they are well into the unit to present guidelines, so as not to circumscribe or otherwise limit student theory development. The result is that students frequently tackle content above the level required for their grade level.

2. Student research. In FCL, students work in small groups to acquire expertise on a designated subtopic, which they will subsequently share with students from other research groups. In Knowledge Building, we try to discourage topic-oriented research and instead encourage research focused on knowledge problems—usually problems of explanation. Although students may work in small collaborative groups, group membership is fluid and students may participate in the work in more than one group and work on more than one problem (Messina & Reeve, 2006). Revising or replacing problems as

knowledge advances is encouraged, thus further calling for flexible involvements. Students are also free to pursue research in multiple ways—through reading, experimentation, consultation, and so on.

3. Role of students' own ideas and "theories." These appear not to be accorded any special role or status in FCL, although they may arise in any of the activities. In Knowledge Building, students are encouraged, before they embark on information gathering, to formulate their own provisional theories in response to knowledge problems they have identified. (Following Popper, we regard a theory to be a proposed solution to a knowledge problem.) Actually, problem definition and initial theorizing tend to go on in concert, each influencing the other. Student research is then focused on theory improvement, as is also the case in mature basic research.
4. Collaboration. Both approaches put considerable emphasis on collaboration in cognitively significant work. This distinguishes them from both traditional instruction, with its emphasis on individual accomplishment, and from conventional project-based learning, with its emphasis on collaboration in the mechanics of prescribed activities. However, the observable products of collaborative effort are quite different. In FCL, the main

products are essentially textbooks, designed for teaching subject matter to other students. In Knowledge Building, the observable products are Knowledge Forum views and notes, with notes taking such forms as "build-ons" to existing notes and "rise-aboves," which synthesize the ideas in a number of other notes. High-level views serve both as a means of organizing collaborative work in a problem area and of communicating major advances and unsolved problems to others. Overall, the collaborative activity in FCL might be characterized as "learning in order to teach" and in Knowledge Building as "working to advance the state of knowledge in the community"—a subtle but profound difference that we will explore later.

5. Whole-class discussion. In FCL, what is called "crosstalk" serves mainly an informational purpose: "In crosstalk, students from the various research groups periodically report in about their progress to date, and students from other working groups ask questions of clarification or extension" (Brown & Campione, 1994, p.235). In Knowledge Building, what is called "knowledge building talk" is more integral to the process of knowledge creation and idea improvement. Although there is reporting of noteworthy findings, the teacher encourages more reflective and forward-looking

discourse: Where are we heading? Are we making progress on the over-arching problems? What new ideas are worth pursuing? New problems and ideas may arise in the discussion that will be further developed in work in Knowledge Forum, perhaps with a new view being created and interested students encouraged ton collaborate in advancing the new strand of knowledge. In general, it seems that the boundary between written and oral discourse is more fluid in Knowledge Building than in FCL: An argument or issue raised in Knowledge Forum may be the stimulus for a fuller whole-class discussion or, conversely, whole-class discussion may set in motion a discourse that is continued through written or graphical contributions in Knowledge Forum.

6. Culminating activity. As is common in project-based learning, FCL calls for inquiry units to culminate in some sort of production or display of the knowledge acquired. Called "consequential tasks" in FCL, they are intended to "bring the research cycle to an end, force students to share knowledge across groups, and act as occasions for exhibition and reflection" (Brown & Campione, 1996, p. 303). Such activities are not a standard part of Knowledge Building. Instead, the Knowledge Forum database constitutes an emergent hypertext (Bereiter, 2002b) that

> embodies the class's knowledge building accomplishments. Students are often encouraged, however, to add "what we have learned" notes that synthesize their discoveries and theories. Sometimes, students will feel they have found out things of such general interest that they should be shared more broadly and will produce a program or display to be presented to parents or to the rest of the school. In contrast to almost all educational approaches, however, we tend to steer away from activities that give a sense of closure, the premise being that knowledge building and idea improvement never end. We find that students have no trouble accepting this and indeed pride themselves on identifying knowledge advances yet to be made, specifying limits in how far they got, and identifying possibilities for linking new work to that now recorded in Knowledge Forum.

A reviewer of a previous version of this manuscript suggested that technology plays the role in Knowledge Building that activity structures play in FCL. This is true to a certain extent, in that such Knowledge Forum features as views and scaffolds (described in Scardamalia, 2002) help in organizing students' knowledge building work. However, we would make the following further observations:

1. The six contrasts presented above remain applicable, whatever technology may or may not be used to support them.
2. The fluidity and flexibility of collaborative activities in Knowledge Building is not a characteristic inherent in the use of collaborative learning technology. There are collaborative learning technologies available that rigidly structure activities, for instance by requiring students to apply a given set of scaffolds in a fixed order, thus turning inquiry into a fill-in-the-blanks exercise.
3. Experienced Knowledge Building teachers sometimes say they couldn't live without Knowledge Forum. We take this to indicate that use of the technology has become so thoroughly woven into their practice that removing it would have a wide-ranging disruptive effect. We conjecture that a technology specifically developed to support FCL activities and principles would acquire a similar "must-have" character. Such a technology would probablydiffer from Knowledge Forum in ways that reflect the 6 differences discussed above. However, some of the student-empowering features of Knowledge Forum might well enrich FCL (cf. Scardamalia, 2003). For instance, recently developed analytic tools enable students themselves to compare the domain vocabulary in their

notes with that in curriculum guidelines and materials. These and other technological supports would probably be valuable for FCL teachers endeavoring to maintain a "metacognitive environment" (Brown & Campione, 1996).

Belief Mode versus Design Mode

In order to look more deeply into the differences itemized in the preceding section, let us consider two problems faced by all constructivist educational approaches: how to ensure that students come into contact with and grasp the deep principles of disciplines, and how to guard against the proliferation and entrenchment of wrong beliefs. (These were major issues in our discussions with Ann.) In both FCL and Knowledge Building the preferred way for students to arrive at the deep principles is through their own efforts, driven by their own curiosity and desire to understand. But both approaches also allow for the teacher to intervene if necessary to ensure that the deep principles are grasped. So what is the difference, and is it only a difference in procedures?

To appreciate a difference that is more than skin deep, we must apply a distinction between what we call "belief mode" and "design mode" (Bereiter & Scardamalia, 2003). Belief mode is so called because its concern is to arrive at true or warranted beliefs. Formal education is conducted almost exclusively in this mode. It covers a wide range, from the most dogmatic to the most critical and reflective pedagogy. Regardless of its underlying philosophy, the pedagogy is to be judged in

belief mode according to the validity of the beliefs that result and the students' understanding and ownership of them.

Outside the schoolroom, however, most creative knowledge work is carried on in a different mode, the one we call "design mode." In design mode, the concern is not with ideas as objects of belief but with ideas as objects of creation, development, assembly into larger wholes, and application. Instead of being judged for its truth claims, an idea is judged according to how well it serves its purpose and on its potential for further development, for leading somewhere desirable. Design mode prevails both within practical enterprises and ones devoted to basic research. Basic research, as viewed within design mode, is not a quest for truth so much as an effort to improve on existing theories.

The difference between FCL and Knowledge Building with respect to deep principles may come down to a difference between a belief mode and a design mode approach. This is admittedly an over-simplification, as both processes are involved in both contexts. To the extent that students in FCL construct and improve explanations and strive to bring explanatory coherence to the work of the community as a whole, they are engaged in design-mode activity. And Knowledge Building students of course consider belief-mode issues of truth and warrant. Both approaches involve work in both modes, but we think the distinction is worth making because Knowledge Building, as far as we know, stands alone among educational approaches in relying primarily on work in

design mode to engage students with deep disciplinary knowledge and to overcome misconceptions and wrong beliefs.

The epistemological basis for our confidence in design mode has been most fully articulated by Wilson (1998) in his book, *Consilience*. Wilson argued that the same deep principles underlie all phenomena, so that if you dig down far enough into any phenomenon you will get to those principles. In Knowledge Building, the digging down is part of idea improvement. It is the part that attempts to answer the *why?* and *how?* questions that arise through inquiry at one level by moving inquiry to a deeper level. Studies of students' work in Knowledge Building indicate that students do in fact gravitate toward deeper explanations through efforts to improve their own theories (Chan & van Aalst, 2003; Hakkarainen, 2003; Hewitt, 2002; Lee, Chan, & van Aalst, 2006; Lipponen, 2000; Oshima, Scardamalia, & Bereiter, 1996).

The teacher's work in design mode is not to guide discovery but to help motivate sustained efforts at idea improvement. Instead of providing pre-structured experiments, the teacher will encourage students to design experiments to test their ideas and will provide assistance as needed to make those experiments possible.[1] (In one instance this involved collaborative design and construction of a wind tunnel to test ideas about flight; in other cases—in doing research on light, for instance—students were able to design, implement, and interpret experiments with very little teacher

support.) Encouraging independent inquiry is not novel, of course (although it may be rare and may be discouraged by highly engineered experimental materials). What is distinctive is having student-designed questions, theories, and empirical work as the principal means by which knowledge is expected to advance in the classroom, with other means subordinate to it. It is in this sense that Knowledge Building students are engaged in real epistemic invention rather than only role-playing.

Inevitably, much of the knowledge and many of the ideas students work with will come from authoritative sources, especially through the written word. This is true of professional-level knowledge work as well. Reading of informational texts may be conducted in belief mode or design mode. You are probably reading this chapter in belief mode, with a goal of adding generally to your knowledge of FCL and Knowledge Building and with an emergent concern about whether the distinctions we are drawing are valid. But if you are a teacher or developer engaged in instructional design work of your own, you may be looking for information or ideas you can use to advance your project. That is reading in design mode and is how we would expect students to be reading informational texts in Knowledge Building—texts they've searched for to improve their ideas, and that , in turn, open up new possibilities for them. Such design-motivated reading may also take place in some phases of FCL, but it would seem that the main

reading effort, which is directed toward preparing a kind of textbook on a topic (for instance, an instructional text on whales or otters), requires reading in belief mode. It is reading to learn (and teach) rather than reading to solve a problem of understanding or to improve a theory.

As traditionally asked, the question whether students can actually create knowledge almost guarantees a negative answer. However, considering the question as it applies to design mode rather than belief mode throws an entirely different light on children's capacity for epistemic invention and the desirability of encouraging it. Of course students can produce ideas that serve purposes, particularly purposes of explanation. And they can work to improve those ideas. Thus they are not play-acting epistemic invention, they are really doing it. But is it a desirable thing for them to do, given the utter unlikelihood that they will produce a theory that improves upon Newton's, let alone Einstein's? When viewed from the perspective of design mode, we can see that the question is very unfairly loaded against the students. The question as stated would cast doubt on the work of countless aspiring scholars who also fall short of improving on the leading theories in their fields but who nevertheless do creative work that is judged deserving of a doctoral degree or tenure. Epistemic invention, in short, can take many forms that are not of Nobel Prize caliber but that nevertheless count as contributions to knowledge. Many of

these forms are within reach of school students, and while they may not be contributions to the knowledge of the world at large they are worthwhile contributions to the knowledge of the classroom community. This does not answer the belief-mode concern with wrong beliefs, but it substitutes an equally valid concern with idea improvement. A simple formula that characterizes what goes on in Knowledge Building is:

Knowledge Building = Useful epistemic invention + Sustained idea improvement

Knowledge Building builds on a natural theorizing tendency (Gopnik, Meltzoff, & Kuhl, 1999). The big challenge is to get students committed to improving their theories, and the classroom operating as a community, with members taking responsibility for advancing not only their own ideas but those of the community as a whole. It is through theory improvement that naïve conceptions are overcome and canonical learning takes place. Without a commitment to improvement, students will tend to confine their activities to belief mode. They will either treat theories as personal opinions, to which everyone is entitled, or they will abandon their own theorizing as soon as they encounter an authoritative theory. Deliberate effort at idea improvement is what moves students out of classical belief mode and into the design mode characteristic of work with ideas in the Knowledge Age.

A Practical Example: Territoriality in Sea Otters

In a 6th grade FCL class we once visited, a "benchmark lesson" was being conducted on types of adaptation. The instructor defined various types and invited the students to provide examples drawn from their research on different animal species. The concepts introduced were quite advanced for the grade level, and the examples students provided suggested they were not grasping some of the distinctions. However, in the course of the discussion the point arose that male mammals often mark off their territory by urinating and defecating along its boundaries. One student then asked how this could work with sea otters. There followed a serious, student-driven discussion (without any of the tittering or toilet humor one might expect in an elementary school class) trying to solve the problem of how in the world an animal could mark off and defend a territory in a constantly shifting medium like the ocean.

This discussion was an obvious departure from the plan of the lesson, but the instructor allowed it to go on, even though it used up all the remaining time. The incident can be viewed from three perspectives. From an instructivist perspective it was a digression that interfered with and perhaps defeated the objectives of the lesson. Most constructivists, however, would probably judge the "digression" to have been the most valuable part of the session. We and the FCL instructor were agreed in this judgment. But here is where FCL and Knowledge Building diverge: Within FCL, excursions into student-generated problems of understanding are welcomed but are not designed into the activity structures. In Knowledge Building, however, students' posing and

collaboratively working to solve knowledge problems is the main point of classroom work. Students' theorizing, reading, writing, experimenting, and discussing are all tied fairly directly to this purpose.

Within the broad constructivist community, discourse about method tends to center around anecdotes. It has therefore struck us as interesting that the anecdotes FCL educators tend to relate are ones like the otter incident. They are not anecdotes about jigsaw, reciprocal reading, or any of the salient activities of FCL. They are, in fact, the same kinds of anecdotes we relate in trying to convey the essence of a Knowledge Building approach. And, of course, other constructivist educators like to tell the same kinds of stories. This suggests what child-centered educators have long argued (cf. Weber, 1971), that inquiry driven by children's own curiosity and puzzlement represents the high-water mark of constructivist education. It is therefore curious and puzzling that almost all contemporary constructivist approaches structure activities so that this kind of inquiry comes as a digression or exceptional event—even if a very welcome one. This seeming inconsistency reflects important strategic differences between FCL and Knowledge Building.

To illustrate these differences, we may consider how the treatment of types of adaptation might have been handled differently in a Knowledge Building classroom. Let us assume, to have a common ground, that learning the different types of

adaptation (anatomical, physiological, and behavioral) was predetermined as a curriculum objective. In a Knowledge Building classroom, this would be made known to the students, perhaps by being entered into the "adaptation" view in Knowledge Forum under the heading of "This is what the Ministry of Education expects you to learn about adaptation." Types of adaptation might or might not become a major focus of student inquiry. In any case, students would be encouraged to link to the objectives list any of their notes that were relevant. (The same notes would be organized differently in other views.) In this way there would be a gradual accumulation of facts and ideas about types of adaptation. Students might bring in examples of adaptation that did not seem to fit any of the types and a new type might be posited. Or it might become evident that the space surrounding "physiological adaptation" was nearly empty and this might provoke a discussion about what this term meant and what examples of it could be found. On the whole, then, we would expect to see more sustained, wide-ranging, and productive effort to understand types of adaptation than results from a benchmark lesson.

Now, what about the otters and territorial marking? We can't assume that the issue would arise in a Knowledge Building classroom anymore than we can assume it would arise in another FCL classroom. It's a low-probability event. But territorial marking, we take it, is not one of the "big ideas" that both FCL and

Knowledge Building are devoted to pursuing. The encompassing "big idea" is territoriality. This is a fascinating concept. The FCL students found it to be so, and we would expect the same of Knowledge Building students. But in Knowledge Building we would expect problems and theories to form around it. What is territoriality for? In what sense is it adaptive? Identifying it as behavioral adaptation is a relatively minor accomplishment compared to building a plausible theory to explain its value in species adaptation. Pursuing that question should lead students more deeply into natural selection and the "selfish gene" theory than they would be likely to get through a general "guided discovery" approach.

Suppose, however, that against the odds some student in a Knowledge Building class did raise the question of how male otters can successfully mark their territory. Most likely it would be pursued in much the same way as in the FCL incident cited—with a flurry of ideas, some related facts, and no real solution. If the issue arose during a whole-class discussion, what occurred might be indistinguishable from what happened in the FCL classroom. But the context and the aftermath would be different. In the Knowledge Building classroom we would expect the issue to be part of a deepening inquiry into the nature and purposes of territoriality, whereas in the FCL incident it was an interesting departure from the predetermined curriculum. If the otter issue

aroused sufficient interest, students might decide to continue the inquiry in Knowledge Forum, creating a view devoted to it and entering notes based on the class discussion, followed by other notes as thinking and research developed. Had the technology been available, the FCL class might have done likewise. We would, however, expect differences in database content reflecting the difference between a learning emphasis and a knowledge building emphasis: We would expect the FCL students to possess and to introduce more information about territorial marking in other species. We would expect the Knowledge Building students to engage in more theorizing, more bringing in of related theoretical concepts, more criticism and efforts to improve explanations.

The contrast we have painted here is no doubt sharper than would exist in reality. We observed one slice of FCL classroom life and inferred the context and follow-up on the basis of general principles; and our portrayal of what would happen in a Knowledge Building classroom is a fabrication based on the best examples we have seen. In real life, of course, practice is seldom as sharply divided as theory. In any kind of intellectually alive classroom, instances of knowledge building are apt to appear, and it would be a rare Knowledge Building classroom in which some information was not promoted because of its foundational value (or because it was mandated by curriculum standards). But in terms of what is focal and what is incidental, we think FCL and Knowledge

Building represent clear contrasts, with less theoretically developed approaches occupying more ambiguous positions.

Can Any Principled Approach Scale Up?

Most of the time in most classrooms the focus is neither on learning nor on epistemic invention but on the immediate task or activity. Ann bemoaned this reductionism. Reciprocal teaching, which she intended should evolve into literate discussion, was too often carried out as if its purpose was to master the RT routine itself. And so a prior question is whether normal classroom activity can be focused on cognitive goals—or is it inevitable that cognitive goals will at best influence the choice and conduct of activities but seldom if ever be foregrounded? One of the principles of FCL is "metacognitive environment" (Brown & Campione, 1996), which means that cognitive goals should have a place in the attention of both students and teachers. Although FCL and Knowledge Building may differ as to what goals should be foregrounded, they are alike in giving long-range cognitive and epistemic goals a high place.

In time-bound activities, however, it is natural to focus on proximal rather than distal goals; in teaching, this means goals of activity management and task completion. The management problems facing the classroom teacher are often so compelling and unrelenting that attention is bound to be drawn to goals that can be achieved in the next minute or fifteen minutes rather than goals

that span a month, a year, or a developmental stage. So it is important to ask of any highly aspiring educational approach both how successfully it can resist degradation and what kind of remnant can be expected to survive when degradation does occur. These are questions we do not see being asked in the educational literature. Instead the literature (particularly the constructivist literature) consists of ideal descriptions, sometimes accompanied by an acknowledgement that successful implementation may require considerable professional development or perhaps a better world. Questions of durability, resilience, and residuum are worth asking about any educational innovation. Considering FCL and Knowledge Building in light of these questions may be especially illuminating.

To put the issues more positively, the challenge is to foster a principled rather than a procedural approach to teaching, in the face of strong pressures that tend toward the procedural. So the first step is to enunciate a set of principles to be upheld. Both Ann and her colleagues and we and our colleagues have worked at this, with continual refinements over the years. Our strategies have been rather different, however. The FCL principles—for instance, *metacognitive environment* and *distributed expertise* (Brown & Campione, 1996)—seem designed to link FCL to concepts that already play an important role in contemporary sociocognitive thought and thus to situate it within an existing theoretical context.

This theoretical context—call it "sociocognitive theory"—is, moreover, much more likely to be meaningful to other academics than to practitioners, who may be only vaguely aware of it. We, by contrast, have aimed to enunciate principles cogent for both academics and practitioners (*collective cognitive responsibility, idea improvement, rise above, epistemic agency, real ideas and authentic problems*) that serve to distinguish Knowledge Building from other sociocognitive or constructivist approaches. This has not proved easy, and we can claim only limited success. As Piaget observed with children, people have a tendency to convert class inclusion relations into false dichotomies. Thus people fail to grasp that Knowledge Building is a form of constructivism but that this does not mean it is merely a synonym for constructivism and that a knowledge building community is a community of practice yet distinguishable from other kinds of communities of practice.

Working from principles, especially in the absence of specific activity structures, has proved exceedingly difficult for knowledge building pedagogy. If you set out a principle that is clearly on the side of the angels, people will tend to find grounds for claiming they are acting in accordance with the principle already and it will essentially be ignored. If the principle strays too far from the familiar, people will claim it irrelevant to their context. Ann used to lament what is fundamentally the same problem, with a different slant. Practitioners would be confident that by visibly using the

FCL activity structures they were in fact "doing" FCL, even though there was no evidence of a "metacognitive environment" or pursuit of deep content knowledge.

Our guess, based on some but probably not enough observation, is that when FCL and Knowledge Building degrade, they degrade to pretty much the same thing. They degrade to the traditional school "project" or "research paper," which consists of facts collected on some topic and organized into a presentation. Although present-day versions are likely to involve computers and the use of Web resources and PowerPoint presentations, the procedures remain the same as those set out in 1950s handbooks (e.g., Warriner, Mersand, & Griffith, 1958; compare Carty, 2005).

"Degrade" is a somewhat misleading term, for it suggests decline from a previous better state. We have seen that happen, but more commonly what is wrong is wrong from the beginning. It seems to be characteristic of pedagogical innovations in general that many teachers who claim and perhaps sincerely believe they have adopted them have in fact continued in their old ways with only superficial adaptations if any to the new approach (Cohen, 1989; Tyack & Cuban, 1995). Consequently, getting teachers started is a crucial problem for FCL, Knowledge Building, and any other innovation that involves a major change in pedagogy (Whitcomb, 2004). The role of explicit procedures in dealing with this problem is itself a strategic problem crying out for controlled

research. The more explicit and distinctive the procedures, the easier they are to institute; and in this regard FCL has it all over Knowledge Building. But adopting procedures without having internalized the principles can lead to a dead end, as Ann lamented. Among promoters of Knowledge Building there is considerable disagreement about the best strategy for getting teachers started. A number favor some kind of "starter" unit in which explicit steps are laid out, the idea being that once teachers see knowledge building happening among their students they will be able to continue on their own. Some even advocate starting with familiar kinds of project-based learning and gradually shifting the projects in the direction of Knowledge Building. The two of us have continued to maintain that principles should come first--that grasp of these principles, along with access to examples drawn from successful Knowledge Building classrooms, is the best way to ensure that real knowledge building will occur. We are now seeing student inventions and analyses of knowledge building based on the students' understanding of the principles.[2] Students' insights into these principles suggest that a principled-based approach is possible. Whether it will ever be as strong as the approach Ann and Joe have established, with activity structures as intermediaries for a principle-based approach, is an important issue we plan to explore, in collaboration with Joe Campione.

If it is true that when implementations of FCL or Knowledge Building fall short the result is conventional project-based learning, this is not a disaster. The traditional project provides practice in a task, producing a library research paper, that (although rarely called for in real life) is likely to be required all the way through schooling, even in graduate school; and, depending on the topic and the approach, it can result in acquiring and retaining substantial knowledge. One of us remembers an assignment back in the fourth grade: to choose a bird, collect information on it, and make an oral report to the class. The bird chosen was the scarlet tanager; and when, 65 years later, one actually appeared at our window, it was instantly recognized, with great pride and delight. If some teachers successfully implement FCL or Knowledge Building while others—perhaps even the majority—get no farther than a slightly enriched version of the traditional project, this would count as a net gain for educational reform. And it is possible that those who do grasp the larger vision will be able to help their colleagues grasp and pursue it as well.

We do believe, however, as Ann and Joe have also emphasized, that it is important for teachers, and for students as well, to grasp pedagogical principles at a deep level. For this purpose, as in all concept learning, contrasts are essential. The contrast between constructivist learning of whatever sort and the stereotype of "drill and kill" pedagogy has outlived its usefulness and needs to be

replaced by contrasts among nearer neighbors. We hope this chapter will be seen as contributing to a new page in comparative pedagogy and not as an arguing for or against either of the approaches discussed.

In retrospect, it is easy to see that FCL and Knowledge Building teachers could not simply incorporate each others' procedures. Rather than again attempt integration, Joe Campione, Carl, and Marlene plan, as a next step, to explore levels of learning and epistemic invention in FCL and Knowledge Building classrooms, with teachers sharing common curriculum goals. We've yet to establish the design for this work, but we are committed to keeping the conversation alive. It represents one of the great joys and challenges of our scholarly lives, and arguably the single most important conversation for our efforts at Knowledge Building.

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[1] The objection that student-designed experiments will fall short in control of variables may be valid, but it is largely irrelevant. The question, "What variables account for X?" is not one students (or theoretical scientists) normally ask and it is not one that brings students into contact with deep principles. Students are inclined to ask "What will happen if…?" or to test the hypothesis, "If my theory is right, X should happen." The latter is much closer to how real science progresses than are the variable-testing experiments so prominent in school science.

[2] A video is available showing inner-city elementary school students discussing the performance of a grade 2 class in light of knowledge building principles and data obtained using analytic tools. As of September 28, 2006, this video was available at http://video.ikit.org/innovators2006.