Learning communities in the classroom

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Abstract. The purpose of the present article is to examine the role of learning communities in the classroom, from psychological and educational perspectives. Four perspectives on learning communities are examined: Ann L. Brown’s distributed-expertise communities, Bereiter’s knowledge-building communities, Lave and Wegner’s communities of practice, and Engeström’s expansive learning communities. It is argued that the educational value of such approaches depends on engaging students in a) pursuit of complex problems, b) sharing of and creating of knowledge, c) breaking boundaries between educational and other communities, and d) promoting the development of students’ agency.

Introduction

Traditional individual conceptions of learning that pre-dominated psychological and educational research over many decades have gradually been yielding space for community-centered approaches to learning; such a change has, however, been the end result of a relatively long developmental process involving theoretical-methodological shifts a) from teacher-centered toward more student-centered approaches that highlight learners’ active constructive efforts; and b) from individually oriented toward socially oriented notions of constructive processes, and c) from laboratory studies toward investigations of learning processes taking place in schools and classrooms as well as in real-world contexts.

Pursuit of classroom learning communities is often legitimatized by contrasting it with the “traditional” forms of instruction based on delivery and transmission of knowledge. The argument is that many aspect of ordinary schooling still rely on behaviorist or rote training principles, highlighting memorization of facts, assimilation of routine procedures, and capitalizing on external rewards. So-called constructivist approaches to learning, in contrast, emphasize the fact that learning takes always place on the basis of a student’s current understanding, involves his or her active “constructive” efforts, and cannot be externally controlled. The cognitive revolution of educational thinking, pioneered by the research of Jean Piaget and Jerome Bruner, involved putting a student and his or her active efforts of knowledge construction and meaning making into the center of educational discourse.

However, the constructive approach to learning focused initially on individual rather than social construction of knowledge. Bruner recounted, “Some years ago I wrote some very insistent articles about the importance of discovery learning – learning on one’s own or as Piaget put it later (and I think better), learning by inventing. What I am proposing here is an extension of that idea, or better, a completion. My model of the child in those days was very much in the tradition of the solo child mastering the world by representing it to himself in his own terms. In the intervening years I have come increasingly to recognize that most learning in most settings is a communal activity, a sharing of a culture. It is not
just that child must make his knowledge his own, but that he must make it his own in a
community of those who share his sense of belonging to a culture. It is this that leads me
to emphasize not only discovery and invention but the importance of negotiation and
sharing – in a word, of joint culture creating as an object of schooling and as an
appropriate step en route to becoming a member of the adult society in which one lives

Many of the early cognitive studies took place in laboratories and experimental settings
addressing processes of thinking, reasoning, and meta-level regulation involved in
learning. Pioneering cognitive investigations of Bruner, Ann L. Brown, and Bereiter and
their colleagues focused on expert-like problem solving; they revealed how complex or ill
defined problems typically frustrate novices due to lack of established procedures, which
leads to excessive cognitive processing load. Research into cognitive scaffolding (Wood,
Bruner, & Ross, 1976) and procedural facilitation (Bereiter & Scardamalia, 1987a)
indicated, however, that when provided with external, supporting tools and structures and
real-time guidance, the novices can be helped to succeed in cognitive processes,
otherwise impossible. Such observations, along with inspiration provided by the
Vygotskian (1978) cultural-historical view of learning, encouraged investigators to move
toward analyzing collaborative learning processes, initially in the laboratory and later on
in actual educational institutions. Research and development of classroom learning
communities emerged as an extension of such efforts.

Detailed examinations of cognitive researchers focused on knowledge and skills
produced by school learning. Toward that end, they investigated whether a) students’
everyday conceptions transformed toward scientific ones, b) the students went through
conceptual change rather than relied merely on weakly restructured and
compartmentalized knowledge, and c) the participants appropriated skills and practices of
scientific inquiry. The initial emphasis on individual learning accomplishments gradually
gave space for examining the significance of social structures and dynamics of inquiry
communities. It was argued that scientific inquiry represents a special kind of cultural
practice that could be imitated by learners through organizing classrooms as inquiry
communities (Brown & Campione, 1996; Carey & Smith, 1995; Scardamalia &
Bereiter, 1994). It was proposed that higher-level learning could be facilitated in school
by organizing a classroom to function like a scientific research community and guiding
students to participate in practices of progressive scientific discourse. Thus, schools
should be restructured as learning communities through facilitating the same types of
social processes, such as public construction of knowledge, that characterize progressive
research communities (Bereiter, 1994). In order to get an idea how inquiry is actually
pursued, the students should systematically participate in processes in which they have to
apply scientific methodology, such as generating research questions, solving complex
problems, constructing hypotheses, building theories, and designing experiments.
Experiences of the actual “doing” of science would help students to make conceptual
change and learn scientific thinking, not just assimilate scientific knowledge as a finished
product of the process (Cognition and Technology Group in Vanderbilt, 1997). It was
argued that a major constraint that prevents conceptual change and development of
scientific thinking is that educational practices do not correspond to the practices of
authentic, scientific inquiry.
Examination of learning in classroom learning communities indicates a significant expansion concerning the concept of learning (Engeström, 1987). Rather than being seen as an individual mental process, learning has been increasingly considered to be a collaborative process that takes place in groups, communities, and networks. Beyond transmission of prevailing knowledge and competence, it involves deliberate building of knowledge as well as pursuit of personal and social transformation (Hakkarainen, Palonen, Paavola, & Lehtinen, 2004). Instead of being only an epistemic process in nature, it is considered to be inseparably linked with existential and socio-emotional processes involved in transforming identities and developing agency (Packer & Goicoechea, 2000). Addressing of such relational processes has required investigators as well as teachers to understand the dynamics of classroom learning communities at a much deeper level than before. Investigators developing community-centered approaches to learning proposed that collaborative experiences both facilitate individual learning and development as well as promote novel collective learning phenomena (Bransford, Brown, & Cooking, 2000).

Hence, the central premise of the learning theory emerged was the socially contextualized nature of human activity: Learning activity relies on socially distributed and self-organizing processes in evolving communities and networks of human actors and supporting tools and artifacts. An important role in this development was played by information and communication technologies (ICTs) in general and technology-mediated learning environments in particular, which provide tools and practices needed for building learning communities within and beyond classrooms. Canadian cognitive scientists Bereiter and Scardamalia (2003) engaged in pioneering efforts to develop groupware systems (e.g., Computer-supported Intentional Learning Environment, CSILE) and its current version Knowledge Forum, Scardamalia, 2002) for eliciting higher-level inquiry and in-depth learning in education.

Four approaches to classroom learning communities

It is essential to reflect on those frameworks and approaches that guide primary and secondary-level teachers in collaboration with researchers in cultivating multi-faceted learning communities if one wishes to improve the quality of education and facilitate the development of skills and competencies required by the future. While learning communities also prevail outside of school and those may play an essential role in informal education, the present investigation focuses mainly on institutional education at primary and secondary levels.

In what follows there will be a review of four approaches to classroom learning communities with a special emphasis on pedagogical applications and empirical investigations; 1) Ann L. Brown’s distributed-expertise (DE); 2) Carl Bereiter’s and Marlene Scardamalia’s knowledge-building (KB); 3) Lave’s and Wegner’s communities of practice (COP), and 4) Yrjö Engeström’s expansive-learning (EL) perspective relevant to teacher education. The four complementary perspectives on classroom learning communities represent diverging theoretical, methodological, and pedagogical approaches to learning. Table 1 describes each of the perspectives as well as associated conceptions of learning, community, and focus of educational innovation.
The present, four approaches rely on diverging views of learning. DE and KB are closest to the cognitive view of learning that examines learning as a matter of acquiring novel schemata and associated knowledge structures, problem solving processes, and associated skills and competencies. DE emphasizes the importance of adopting big principles and core ideas of curriculum in conjunction with developing basic as well as metacognitive skills (Brown, 2007). As explained later on in more detail, KB separates learning from knowledge building (Bereiter, 2002) and sees the former as a side-effect of the latter. Simultaneously, it sees learning as a process of building personal skills and competencies needed for working creatively with knowledge. Due to Bereiter’s (2002) criticism of the mind as a container metaphor, it does not locate the skills within the human mind, but sees these embedded in relations between learners and the knowledge problems encountered. In accordance with foregrounding conceptual aspects of learning, both of these perspectives are concerned of conceptual change taking place in successful learning process.

A common denominator of COP and EL is focus on social practices as distinguished from conceptual and discursive (i.e., language-related) processes. Social practices are assemblages of human activity that involve goal-directed sequences of actions using certain technology and rely on a socio-historically developed system of knowledge (Schatzki, 2001, Scribner & Cole, 1981). The participants have to develop capacities for pursuing coordinated actions that involve applying cultural knowledge in particular settings of their activity. Current theories of social practices highlight both the inseparability of knowing and doing and the creative and improvisational aspect of practice: “Far from being the locus of mechanical repetition and mindlessness, practice is instead a key to the comprehension of knowledge-related phenomena. It is in practice, in fact, that knowledge comes to life, stays alive, and fades away. It is in practice that institutionalized, historically determined, and codified expertise acquires sense and becomes both a resource and a constraint for action” (Nicolini, Gherardi, & Yanow, 2004, p. 26).

Accordingly, COP examines learning as a process of growing up and socializing to a community and acquiring the skills to communicate and act according to its socially negotiated norms. Learning is a process of taking part in social practices and moving gradually from peripheral to central participation in the activity in question. The focus of COP is on knowing rather than on cognitive outcomes or knowledge products as such. This approach highlights the situated nature of human knowledge and cognition and, consequently, human activity is seen to be inseparably bound to its social and material environment. While COP is a multi-faceted approach and involved various educational implications (Wegner, 1998), the present article focuses only on those aspects that involve integration between educational practices with authentic expert practices prevailing outside of educational institutions.

While COP focuses on the appropriation of community's knowledge and adaptation to existing cultural practices without a deliberate effort for transformation, deliberate organizational change is the specific focus of EL (Engeström, 1987). This framework examines learning as a dialectical process of transforming collective activity systems through overcoming historically accumulated tensions between elements (e.g., subject,
instruments, object, rules, community, division of labor) of activity systems; the corresponding section involves a more detailed explanation of relevant issues. Collective reflection and formation of **activity concepts** (Engeström, et al., 2005) may play a crucial role in making visible, reflecting on, and transforming activity; here, concepts are seen to be inherently embedded on activity guiding and directing its transformation. Expansive learning involves breaking boundaries of prevailing practices. It often involves expansion of the object of activity in spatial and temporal terms (Engeström, Puonti, & Seppänen, 2003); i.e., a learning community may start working with a more complex object, relying on new instruments and changed mutual division of labor.

Each of the four approaches has its own specific view concerning the nature of learning communities in the classroom. DE and KB appear to consider classrooms as potential learning communities without too much problematization (compare Roth & Lee, 2006). The former approach examines classrooms as communities based on heterogeneously distributed expertise; under teacher guidance such communities may be engaged in pursuing conceptually central, curricular topics and developing the participants’ metacognitive skills during the process. As explained below, a specific effort is invested on guiding the participants in deepening (expert groups) as well as sharing (reciprocal learning groups) their expertise. The KB approach aims at reorganizing classrooms as knowledge building communities that endeavor to advance collective knowledge by capitalizing on student-driven questions and to assume collective cognitive responsibility for knowledge improvement (Bereiter & Scardamalia, 2003). While students cannot be expected to master advanced-levels of cultural knowledge, they are assumed to be able to build a developing body of locally shared cultural knowledge with assistance of technology-mediated learning environments and a committed teacher, and, aside from content, develop the rudiments of a methodology for pursuit of knowledge.

While all of the present approaches may be regarded to be socio-culturally oriented, there is continuity between DE and KB and a cognitive view of learning in respect of highlighting conceptual aspects of learning, whereas COP and EL are clearly practice-based in nature. COP and EL examine classroom learning communities as embedded in social practices; from the perspective of such socio-culturally oriented approaches, the DE and KB rely on a conceptually biased notion of community. With such approaches, school attendance and activity is considered as one historically evolved social practice among others that should not be taken as given. While the prevailing educational practices involve solving relatively well-defined tasks for assimilating pre-selected “autonomous texts” (Olson, 1977), newer approaches may provide expansive possibilities that allow students to attain societal objectives of schooling. From the perspectives of COP and EL, relations between education practices and those of other cultural communities become essential: “Instead of treating the school as a container filled with teacher cultures, student subgroups, classroom instruction, and administrative micropolitics, I look at ... school ... as an intersection in social space, a knot in a web of practices that stretch into complex system beginning and ending outside the school. Instead of looking at educational setting – school, classroom and so forth – as having clear boundaries and identifiable content, I look at them as extensive in space and time, fluid in form and content, as intersections of multiple networks shaping cities, communities, schools, pedagogies, and teacher and student practices (Nespor, 1997, xii, quoted by Eisenhart, 2001).
On the basis of these kinds of considerations, COP may be interpreted to support the proposal that educational practices should be transformed toward those of authentic cultural communities by breaking the boundaries of educational and professional institutions. COP has inspired educational researchers’ efforts in cross-fertilizing educational and professional practices by means of project-based learning and student-expert partnership, to be examined in the following pages. EL, in turn, examines classroom learning as a process embedded in a historically evolved activity system based on mediating instruments, pursuit of corresponding objects; one which relies on certain rules, communities, and division of labor between teacher and students. Students’ activity takes place in a network of activity systems representing their homes, friends, and local communities. Expansive learning often involves renegotiating relations between activity systems and crossing boundaries between them. Conceptualization plays an essential role in EL as dynamically evolving tools of reflecting on and transforming EL examines conceptualizations play an important role.

While the notion of “classroom learning community” appears to provide productive possibilities by means of highlighting collaborative aspects of learning and engaging school classes to meaningful inquiry-oriented activities, it is important that one be aware of the limitations of such an approach. Roth and Lee (2006) examined the nature of educational discussion concerning DE, KB and COP from the perspective of cultural-historical activity theory. Their analysis indicated that the educational researchers often used of the concept of “community” in very shallow way, frequently without any deeper theoretical foundations whatsoever; they assumed that classrooms as such constitute learning communities; whatever group of agents (e.g., students) that was brought together for a short time was considered to represent a community. Yet groups of learners under a teacher’s guidance do not necessarily constitute genuine communities. Such criticism appears to apply to Stahl’s (2006) “group cognition” that involves analyzing ac-hoc groups meeting on the Internet to solve math problems together. In many cases, such groups do not have any history, shared practices worth talking about, or significant future trajectories.

In order to be considered a community of learning, a group of students needs to have a shared object of activity. While this is likely to be the case in the most innovative pedagogical experiments involving iterative cultivation of corresponding classroom practices across extended periods, it is something that has to be shown, case by case, rather than assumed. It is also essential to acknowledge that classroom learning communities are always heterogeneous in nature; as a consequence, there is not just one coherent community but a heterogeneous body of partially conflicting practices, diverging intentions, and multi-faceted motives (Eckert, 2000; Phelan et al., 1996, Gutierrez, Baquedano-Lopez, Alvarez, & Chiu, 1999). Moreover, while the four perspectives examined in this paper can be analytically distinguished, these approaches have affected one another in many ways so that the actual pedagogical practices may share characteristics of several frameworks rather than correspond with one, particular, ideal type. It is important to keep these issues in mind when reading descriptions of the four complementary perspectives in the following pages.

**Distributed-expertise (DE) community**
Cognitive research on expertise inspired many educational researchers to examine how corresponding higher-level thinking skills could be elicited in education (Bruer, 1993; Hakkarainen, Palonen, Paavola, & Lehtinen, 2004; Hatano & Inagaki, 1992). A central assumption of Ann Brown’s *Distributed-Expertise community* was that each member of a learning community, including the teacher, has more expertise than others in some domain of activity (Brown et al., 1993; Brown & Campione, 1994; 1996). In spite of being more knowledgeable than students, even the teachers do not have all of the available expertise within the classroom. The distributed-expertise model considers differences in the students’ interests and knowledge as resources that enrich and benefit the learning and instruction process. This is clearly different from a traditional orientation that addresses heterogeneous knowledge and competences mainly as instructional constraints, problems, and challenges. The idea is to support each student in the development of his or her expertise; this is called “majoring”. All students do not have to have all the exact same information and competence; instead each student’s unique expertise can be cultivated within selected domains of inquiry. In the background is the notion that the multitude of knowledge and competence amongst students will support the community’s action in the same way as biodiversity elicits growth of a natural habitat. Simultaneously, it is essential that certain basic skills and competencies be mastered by all participants.

In the background of DE pedagogy there was long-standing experimentally oriented research on reciprocal teaching (Palincsar and Brown, 1984; Brown & Palincsar, 1989); this method was designed to mediate critical cognitive actions involved in reading with understanding. The aim was to facilitate reading comprehension of children who had well-developed mechanical reading skills, but who were not able to understand the text that they read. The objective of reciprocal learning was to elicit the collective interpretation of meanings within the text and the sharing of knowledge amongst the students. The idea was to transform expert students’ internal and normally unseen processes of working with knowledge into external ones that can be imitated and appropriated by other students.

Reciprocal teaching progresses in the following way: a group of students and a teacher read texts in a small group. Everyone directs the progression of discussion when it is his or her turn. The groups are deliberately heterogeneous in nature, being composed of students who have problems with reading as well as students who are already fluent readers. The group practices a number of strategic epistemic actions that good students spontaneously use to regulate their self-directed text-comprehension activity, such as 1) posing questions for the text; 2) clarifying the main points in the text; 3) making summaries of the text, and 4) predicting the progression of text. The overall DE approach aims at eliciting the development of corresponding metacognitive competencies in all participants.

The group is jointly responsible for understanding and evaluating the content of the text. The student whose turn is to lead of the discussion poses questions about the main content of the text and draws together the groups’ conclusions. Whenever diverging interpretations emerge, the participants re-read the text and discuss their questions, inferences, and conclusions. When working toward conclusions, the group can evaluate their advancement, address disagreements, and anticipate contents of subsequent parts of
the text. The discussion has a double focus on interpreting the meaning of the text and reflecting on comprehension strategies of the participants. “Reciprocal teaching involved the development of a mini-learning community, intent not only on understanding and interpreting texts as given, but also on establishing an interpretative community (Fish, 1980) whose interaction with text was as much a matter of community understanding and shared experiences as it was strictly textual interpretation” (Brown, 2007, p. 7). While researchers were developing the notion of DE, individual pieces of text gradually gave space for more complex bodies of knowledge collaboratively explored by the participants.

According to Wertsch’s (1998, 124-130) analysis, the reciprocal teaching method is about providing mediating cultural tools to the students and facilitating their gradual appropriation of the tools as a repertoire of their own activity. With the method, it is possible to have students gradually absorb cognitive and metacognitive functions central to understanding the text in such a way that performance precedes competence (Cadzen, 1997, quoted according to Wertsch, 1998, p. 132). Students used cultural tools, such as routinely pursued epistemic activities of questioning and summarizing, to practice reading before they properly understand the significance of the tools or know practices of their proper usage. The reciprocal method is an attempt to deliberately create new patterns of participation, where the active role of the students themselves is emphasized. Brown and Palincsar (1989) succeeded, with reciprocal learning, in raising the level of understanding amongst students suffering from reading difficulties, to a normal level after a relatively short period of reciprocal teaching training. Corresponding activities were used to guide students in sharing their knowledge and achievements in the context of their inquiry projects.

Reciprocal teaching is a concrete example of the educational value of classroom learning community. Under this approach, the participants can be guided to appropriate expert-like practices of reading, functioning in an expert’s role, and sharing intellectual achievements. A further step is to organize a learning community to work in the same way as an expert community; to encourage students to solve challenging problems together and to share their own expertise. Accordingly, the DE model involved generalizing experiences and practices of reciprocal teaching to facilitate learning in a normal school environment. Students are engaged in an inquiry focused on pursuing conceptually central, learning topics (“big ideas”) under the teacher’s guidance. The teacher plays an important role in the process by means of preparing, guiding and evaluating students' inquiries, learning together with them, and socially organizing their shared inquiry activities.

Structuring participation in collaborative process using the jigsaw method (Johnson & Johnson, 1998) is an essential aspect of Brown’s approach (Brown et al., 1993; Brown & Campione, 1994; 1996). Accordingly, the members of a learning community are guided to work in two kinds of groups. The purpose of the so-called expert group is solving some problems or learning assignments. The task is usually in nature such that no single group can solve it alone, and that it requires cooperation between the groups and the sharing of knowledge between students (so-called ‘shared task’). Reciprocal learning groups, in turn, are formed in such a way that one representative from each expert group is participating in such group. It is the responsibility of this expert representative to
explain the results achieved by his or her expert group to the representatives of other groups at the reciprocal teaching group. The reciprocal teaching groups make it possible to ensure that the results of each group’s inquiry are passed on to other groups. Specific structures of social activity are needed to make sure that all participants have to take part in inquiry rather than “hitchhike” on efforts of their peers. They are expected in parallel to take part in presenting the results of investigations as well as function as an audience.

Brown’s approach highlights the importance of having an object or higher-level task shared by the whole classroom community. At school, tasks are most often chopped into differentiating individual assignments, which the students distribute amongst each other into parts which suit each participant. In ordinary group working, the object is thus not the phenomena being studied so much as it is a system of distributing roles and partial tasks (Gutierrez et al., 1999). Shifting from this kind of group work toward a genuinely collaborative process and the distribution of expertise is a challenge for adults as well as students. Sharing expertise involves carrying out a distributed assignment that the participants cannot accomplish on their own. To take Manned Mars Voyage project, one of Brown’s and her colleagues’ examples from junior high school, distribution of expertise within a classroom may take place as follows. The students were divided into the following expert groups; 1) surface, 2) crew, 3) health, 4) ship, 5) history, and 6) voyage. The task of the surface team was to plan investigations taking place on the surface of the planet Mars. The task of the crew-group was to analyze what kind of expertise would be needed on the voyage and to design the composition of the crew. The health group was supposed to think about ways of overcoming the health issues that are a result of zero gravity. The ship’s crew designed the spacecraft and the voyage crew designed what kind of expertise would be needed on the voyage and to design the spacecraft and voyage crew designed what kind of a launch window would be wise to use. The history group thought about the problems relating to the colonization of Mars from the perspective of historical problems with colonialism. None of the groups could have designed the voyage alone; instead all groups were needed to formulate the plan. The overall task of planning the voyage constituted the shared object of the project.

In the background of DE is Vygotsky’s (1962; 1978) notion of the zone of proximal development (ZPD), which represents forming and emerging competencies of an individual. The social community may assist the individual in reaching his or her ZPD by creating external support structures with which he can carry out more demanding tasks than would otherwise be possible for him (Brown et al., 1993, p. 191). The lower boundary a ZPD is defined by epistemic actions that an individual is capable of independently, and the upper limit according to what he can achieve in the guidance of a more able person or with technology-mediated tools and environments. In a heterogeneous social community, a group of overlapping ZPDs can be created, which direct the individual in adopting such cultural practices, which he or she cannot yet control, but which are part of his or her ZPD. While such an individual application of ZPD makes sense and provides a usable framework, in the section concerning EL, the topic of a collective interpretation of ZPD will be addressed. Through reciprocal teaching, the students reach into their group’s (ZPD) and, with its help, surpass the boundaries of their previous learning.

Working in the role of an expert is cognitively valuable and can help to expand the learning community outside the borders of the school. Working in the role of an expert,
setting the assignments related to it and the carrying of collective cognitive responsibility (Scardamalia, 2002) support students’ learning and development. Simultaneously, the opportunity to step into the role of an expert makes learning more meaningful and can give the students the feeling of ownership concerning their own learning. Expertise is actually adopting a social role (Stein, 1997) which is loaded with expectations, to which the development of a specific identity is related. It is also very productive to ask the students to explain their achievements to students from other classes, parents or visiting experts; this is likely to encourage them to engage in deepening inquiry. Such project presentations constitute a form of dynamically evaluating advancement of the participants’ learning. Brown’s approach reveals how people can, by networking and sharing expertise, surpass their own individual cognitive boundaries.

As mentioned above, one of the central ideas of collaborative learning is to make the strategies of thinking and learning that are spontaneously used by high-achieving students visible for all students. These strategies should be molded into such a form that they are easy to imitate and appropriate. A student who succeeds well does not, however, have to be on the side that is giving, even if he or she would share his or her own knowledge and competencies above all. This is because functioning in the role of teacher is the most effective way of learning. When teaching something to someone else, the criteria of understanding are significantly more demanding than while studying alone: it often happens that only when one starts to teach something to someone else, does one realize the gaps in one’s own understanding. A student who teaches something to others learns just as much or even more than the students that he is supporting. In-depth learning may be facilitated both through explaining problems to oneself as well as explaining them to the others. Acting in a teacher’s role has developmental effects on any student, so the challenge is to get the students to act as each other’s teachers from time to time. Struggling to understand another student’s point of view and finding a correct approach to comprehending a complicated issue deepens the understanding of both students. In such collaborative interactions, the participants have to negotiate relations between different social and cultural worlds of knowledge; this is likely to facilitate creation of new knowledge and transformation of knowledge practices. Consequently, collaborative learning is not just one method amongst others, it has basic, strategic significance in educational activity. Creating a genuine classroom learning community is not easy or effortless, however; it requires tenacious practice and the questioning of prevailing practices and cultural models.

Investigations of Brown and her colleagues have indicated that distributed-expertise pedagogy in general and reciprocal-teaching pedagogy in particular have produced encouraging learning outcomes. Comprehensive structuring of collaborative inquiry processes characteristic of this framework elicits its pedagogical implementation and facilitates scaling up of corresponding practices of learning and instruction. Simultaneously, such structuring, which may provide a misleadingly straightforward picture of pedagogical implementation, may, however, also be the Achilles heel of Brown’s framework. While Brown’s pedagogical approach is widely disseminated, many of these imitations are only superficially similar to the original ones since they do not follow the prescribed principles of learning or do only partially so (see Brown, 2007, p. 12). As a consequence, these non-satisfactory pedagogical replications do not produce as impressive learning results as reported by the original studies. This is related to the
challenge of creating social practices within a classroom that channel the participants’ learning efforts and metacognitive activities in a way that fosters higher-level inquiry. The role of social practices in fostering classroom learning communities will be addressed in the end of this chapter. Another critical question is to what extent distributed-expertise pedagogy is driven by pre-determined “big ideas” selected by teachers with their agenda versus founded on emergent lines of inquiry driven by questions generated by students or arising in interaction with external communities. In this regard, the distributed expertise framework is questioned by developers of the knowledge-building approach (Scardamalia & Bereiter, 2007). The latter approach would likely put students’ own knowledge advancement efforts into the centre of classroom learning community to a greater extent than would the distributed expertise approach.

Knowledge building community

Another approach to the communities of learning in the classroom was initiated by Canadian cognitive scientists, Carl Bereiter and Marlene Scardamalia. This approach diverges from that of Ann L. Brown in being, since the 1980s, explicitly focused on developing technology-enhanced learning environments for scaffolding classroom learning communities. While Brown’s approach addressed social organization of collaborative learning, the knowledge-building approach has focused on having students themselves pursue knowledge objectives involved in education (Bereiter & Scardamalia, 1993; 2003; Scardamalia & Bereiter, 1994; 1999; 2006). These two approaches have affected one another in many ways and engaged in direct collaboration within the frame of Schools for Though project (see Bruer, 1993; Lamon et al., 1996). The above described social infrastructure of distributed-expertise classes comes fairly close to that of knowledge building classes; consequently, the following discussion will mainly focus on those aspects of knowledge-building communities that diverge or go beyond of Brown’s approach.

The background of knowledge-building was in cognitive research on learning and writing. Bereiter and Scardamalia (1987a) were studying experts’ and novices’ strategies of written composition. Their investigations revealed that experts experienced writing assignments as being much more difficult than did novices; in this regard, writing diverged from all other areas of studying expertise in which novices had trouble (Scardamalia & Bereiter, 1991b). When novices were given a writing assignment, they felt the task easy and simply wrote down whatever came to their mind in the form and order of its activation. This was characterized as knowledge-telling strategy. Experts, in contrast, engaged in complex problem solving taking place in two problem spaces in parallel; they, simultaneously considered what they know of the topic (content space) and what would a prospective reader know about it (rhetorical space). The written composition emerged through a troublesome and iterative pursuit through the two problem spaces. Because they tended to considerably advance the initial knowledge and understanding, this was called as knowledge-transformation strategy. Careful experiments revealed that the knowledge-transformation strategy characteristic to experts could not be conveyed to the novices due to excessive cognitive load during the process. When novices writing process was, however, facilitated by putting small notes on the table addressing certain basic aspect of writing, such as “Have you defined all concepts?” and “What do readers already know about the topic?”, the resulted to significant
improvements. This is called as “procedural facilitation” (Bereiter & Scardamalia, 1987a); it improves the participants’ performance on the condition that it is provided during the problem solving process rather than in advance or retrospectively.

In parallel of these investigations, Bereiter and Scardamalia (1993) noticed, as mentioned in the context of Brown’s study, that there were expert-like learners, i.e. young students who followed similar practices of working with knowledge to those of experts. These students did not treat problems encountered as routine, but went to a great deal of trouble in trying to understand the issues in question. Although expert-like students did not have knowledge comparable with that of experts, they tended to set up for themselves similar challenging epistemic goals as experts do (Bereiter & Scardamalia, 1987b). Rather than focusing on task completion, they appeared to have knowledge-advancement goals toward which they worked, doing more than they formally had to do. This strategy diverges from common observations that students give up trying to solve a problem if they do not find a solution to it within a few minutes (Schoenfeld, 1983). Many students also tend to reduce a new problem to one that they have already mastered so that their activity resembles problem reduction, rather than progressive problem solving. While the initial studies were somewhat individually oriented, Scardamalia and Bereiter (1991a) focused on pursuing interventions concerning classroom learning communities and developing supporting technology-based learning environments so as to assist ordinary students to engage in similar epistemic processes that characterize the expert-like learners. In this regard, the initial motivation of Brown’s and Bereiter’s and Scardamalia approaches are close to one another.

From research on procedural facilitation and intentional learning, emerged networked learning environments that facilitate various aspects of literate – writing-based – inquiry. Bereiter and Scardamalia engaged in developing groupware systems for eliciting higher-level inquiry and in-depth learning in education; the resulting Computer-supported Intentional Learning Environment, CSILE and its current version Knowledge Forum (Scardamalia & Bereiter, 1991a; 1994; 1999) are highly regarded. Such environments are built around a communal database that is practically empty when starting a knowledge-building project. The participating students are engaged in creating all knowledge in the database by creating textual and graphical computer entries called notes. These notes can be visually organized, interlinked, grouped, and arise within a series of thematic views created by the students themselves. By engaging the participants in meta-level classification of their contributions according to crucial aspects of inquiry, such as Problem or My Theory, participation in higher-level inquiry can be “scaffolded” by knowledge-building environments. Systematic research on computer-supported collaborative learning led Scardamalia and Bereiter (1991a) to greater awareness of the educational value of collective agency involved in cultivation of classroom-based learning communities. Students that were engaged in collaborative building of knowledge within CSILE communities appeared to develop shared epistemic norms and engage in progressive discourse that assisted in going beyond their epistemic horizons (Bereiter, 1994).

Bereiter and Scardamalia (1993) proposed that schools could be developed toward “knowledge-building” communities dedicated to elicit expert-like creative working with knowledge. The participants of such communities are engaged in creating, sharing, and
advancing a student-generated epistemic artifact. In order to consider ideas as improvable artifacts (objects) rather than fixed beliefs, the participants are guided to move from belief mode to design mode (Bereiter & Scardamalia, 2003). It is a characteristic of the former to consider whether you agree or disagree about an idea or whether you consider is true or false. Design mode, in contrast, implies asking how can ideas be used, what are their strengths and weaknesses in this regard and how can the ideas be improved and elaborated. The shared objects with which the participants worked were most of all conceptual artifacts (questions, hypotheses, and theories) embedded in pursuit of multifaceted projects with epistemic and pragmatic elements and outcomes.

Bereiter (2002) distinguished learning from knowledge building by arguing that former is oriented toward gains in individual learning and understanding whereas knowledge building is focused on advancing collective knowledge. In this regard, a useful example of knowledge-building projects is provided by the so-called Citizen Memory project.\footnote{The project was designed and organized by Raimo Parikka and his colleagues from the University Helsinki.} Lower secondary school students from the MATAPU (Malmi-Tapialia-Pukinnäki suburbs located in Helsinki, Finland) area have been participating, in collaboration with local communities of inhabitants, in a project that focuses on collecting information about local history. In the background was the idea according to which writing history is not just the privilege of historians; instead it is everyone’s business. The project aimed at searching for information about how people used to live in the area and how the neighborhood had changed. The students were guided to interview their grandparents and other elderly people in order to examine how they had lived in earlier decades. These interviews were transcribed from audiotapes and posted on the web, together with digitized photographs, so that a continuously growing body of local knowledge emerged. In so doing, the students engaged in knowledge-building, rather than just learning. They constructed a very rich database that could be used, reorganized and analyzed by other students, researchers or teachers, and, therefore, their activity went beyond the boundaries of mere learning. The project also involved an effort to build a larger community of schools and local organizations, an arrangement that appears to foster knowledge building. The purpose of the project was not for students to memorize old people’s memories about the history of their area of the city. Instead they processed information in the same way as history researchers, working to create their own interpretations and learning how research is done in history.

In order to describe desirable characteristics of social practices cultivated in knowledge-building communities, Scardamalia (2002) suggested the following 12 knowledge-building principles (http://lcp.cite.hku.hk/resources/KBSN/Q1/KB_Principle.html): 1) Working with real ideas and authentic problems; 2) Treating ideas as improvable artifacts; 3) Capitalizing on idea diversity; 4) Facilitating epistemic agency through negotiating relations between personal and collective knowledge; 5) Assuming collective responsibility for advancing community knowledge; 6) Democratizing knowledge by respecting each participant’s contributions; 7) Engaging in symmetric knowledge advancement between communities; 8) Making knowledge building a pervasive aspect of everyday activity; 9) Using authoritative sources constructively; 10) Engaging in
knowledge-building discourse focused on advancement of knowledge; 11) Pursuing embedded, concurrent and transformative assessment of inquiry, and 12) Aiming constantly at rising above earlier inquiries. Systematic cultivation of inquiry practices consistent with these principles may assist a teacher in building a knowledge building culture in his or her classroom.

There are many successful examples of knowledge-building research programs. Hakkarainen (1998, 2003a; 2003b; 2004) carried out detailed qualitative analyses of 10-to-11-year-old students’ inquiry culture in a computer-supported classroom. The technological infrastructure of the students’ inquiry was provided by an early version of Knowledge Forum specifically designed to facilitate working with shared knowledge artifacts (Scardamalia & Bereiter, 1994). The investigation indicated that knowledge produced by the school class in question was at a very high explanatory level both in biology (Hakkarainen, 2003b) and physics (Hakkarainen, 2004). In accordance with knowledge produced by the participants, practically all research questions posed by them were explanation seeking in nature. Moreover, the students pursued their research questions in depth, following the pattern of interrogative activity (Hakkarainen & Sintonen, 2002). Accordingly, the students undertook their inquiry with initially very general and unspecific “big” questions and tentative working theories, and tried to solve the initial questions by searching for answers to a series of subordinate questions (Hintikka, 1999). This process was facilitated in the learning environment by provision of a special scaffold, the I-Need-to-Understand [INTU] question, for generation of subordinate questions. The analyses indicated, further, that the students made considerable conceptual progress (Hakkarainen, 2003b; 2004). Because the students’ progress was assessed by examining their written productions, the evidence of conceptual progress was not, however, conclusive, and there were some indications that the physical study projects (gravity, cosmology) were too complex for students to understand in depth.

It is possible to try to abstract the core processes involved in classroom-based inquiry communities and, on the basis of these, implement corresponding pedagogical practices at primary and secondary levels of education. This transformation is not an easy task because it not only requires a change in fundamental assumptions about the nature of learning and knowledge but also necessitates corresponding transformation of epistemic practices prevailing at school. In order to communicate corresponding ideas to teacher practitioners, Hakkarainen and colleagues have developed a pedagogical model of progressive-inquiry learning (PI model, Hakkarainen, 1998; Hakkarainen et al., 2004; Muukkonen, Hakkarainen, & Lakkala, 2003; Muukkonen, Lakkala, & Hakkarainen, 2005). The model relies on cognitive research on educational practices and is closely associated with both Brown’s distributed expertise approach, Bereiter & Scardamalia’s (1993; 1994; Bereiter, 2002) knowledge-building approach, and Jaakko Hintikka's interrogative model of inquiry (Hintikka, 1999) (Figure 1). The model is being implemented, tested and developed in various schools, universities, and also in some workplaces.

Insert Figure 1 about here

Progressive inquiry entails that new knowledge is not simply assimilated but constructed through iterative efforts in solving problems of understanding, applying and extending prevailing communal knowledge, and reaching beyond the edge of the epistemic horizon.
By imitating practices of mature knowledge communities, the participants can be guided to engage in extended processes of inquiry. It may be a good idea to set up some general questions, which the community will focus on solving. These questions may emerge from reflecting on current practices and problems and tensions encountered, or may represent some general issues in which the participants are interested. Thus, the topic may be practical or more conceptual in nature. Progressive inquiry often takes the form of a project; the participants work in teams having both individual and collective goals of inquiry. An essential aspect of this kind of inquiry is to engage collaboratively in improving the shared knowledge artifacts (objects), such as hypotheses, theories, interpretations, design, plans) or pursuing other mediating trialogical objects (e.g., concrete products, prototypes, procedures to be organized) that emerge during the process. The epistemic artifacts worked on do not need to be formally very sophisticated, just ideas that concern the participants.

In what follows, a conceptual framework of progressive inquiry is outlined and each aspect of inquiry briefly discussed. The model is designed to facilitate engagement in an in-depth process of inquiry, and expert-like knowledge practices, both of which are essential to productive participation in a knowledge society.

Shared expertise

The participants of knowledge-creating inquiry are not isolated individuals but members of classroom learning communities as well as the community itself. All aspects of inquiry to be elaborated as follows, such as setting up research questions, searching for new scientific information, constructing one’s own working theories, or assessing the explanations generated, can be shared within the fellow inquirers. Advancement of inquiry can be substantially elicited by relying on socially distributed epistemic resources, emerging through collaborative efforts to advance shared knowledge and understanding. As argued by Brown as her colleagues, groups which consist of members having heterogeneous but partially overlapping expertise, are more effective and innovative than groups with homogeneous expertise.

Creating Context

The starting point for the process of inquiry is the joint creation of a context for the project in question. In educational contexts, it is essential to ensure that the inquiry focuses not only on learning autonomous text for school, but also assumes a more substantial aim as the object of educational activity. It is crucial that the topic is sufficiently complex to warrant study, and worth a personal commitment. Through creating a context, the issues being investigated are connected with deep principles of the knowledge domain in question, and anchored in authentic and complex real-world problems world.

Engaging in Question-driven Inquiry

An essential aspect of progressive inquiry is generating the participants’ own problems and questions to guide the inquiry: There cannot be a genuine process of inquiry without questions generated by the participants themselves. Questions that arise from the participants’ own epistemic efforts and needs have a special value in the process of inquiry. In pursuit of learning with understanding, explanation-seeking Why and How
questions have specific epistemic values. The members of inquiry community should be encouraged to focus on questions that emerge from the gaps of their own knowledge and understanding (Bereiter, 2002; Scardamalia & Bereiter, 1994).

Generating Working Theories

An important aspect of inquiry is generation of one’s own conjectures, hypotheses, theories or interpretations of the phenomena being investigated (Bruner, 1996; Carey & Smith, 1995; Scardamalia & Bereiter, 1993). Construction of their own working theories guides the participants to systematically use their background knowledge and become aware of their presuppositions. Progressive inquiry is aimed at facilitating explication and externalization of these intuitive ideas through guiding the participants to write about their ideas and taking them up as objects of collaborative reflection and advancement.

Critical Evaluation as a Component of the Process

Critical evaluation addresses the need to assess strengths and weaknesses of the working theories and explanations produced so as to direct and regulate the advancement of inquiry. It is essential to focus on constructively evaluating the advancement of the inquiry process itself, rather than simply assessing the end result. An inquiry community would do well to assess, in parallel, advancement of both individual and collective knowledge and inquiry. The participants' and their teams' self-assessments have a crucial role in the evaluation process, in conjunction with the efforts of the teacher. Critical evaluation is a way of helping the community to rise above its earlier achievements by creating a higher level synthesis of the results of inquiry processes.

Searching for New Information

The question-driven process of inquiry provides heuristic guidance in the search for new information. Student-generated questions often drive inquiry beyond teacher’s initial assumptions, assist managing large bodies of information, and using authoritative sources constructively (Scardamalia, 2002). New information may be provided through using literary sources, consulting experts or conducting one’s own explorations. Comparison of the intuitive working theories produced and well-established scientific theories tends to make explicit the weaknesses and limitations of collective knowledge.

Engagement in Deepening Inquiry

In pragmatic problem-solving situations, generating questions and tentative theories must be initiated before all the necessary information is available. As a result, the process of inquiry starts with initially very general, unspecified and “fuzzy” questions and tentative working theories (Hakkarainen & Sintonen, 2002). A critical condition for progress is that the participants focus on improving their ideas by generating more specific questions and searching for new information. The dynamic nature of inquiry arises from the fact that the generation of intuitive explanations and obtaining new scientific information make new research questions accessible, a situation that could not have been foreseen in the beginning of the inquiry. By finding answers to subordinate questions, a student approaches step by step toward answering the initial question.

The progressive inquiry model is a tool that assists teachers in engaging their students in expert-like creative knowledge practices. The teachers should guide students themselves to assume responsibility for all aspects of inquiry, such as goal-setting, questioning,
explaining, and evaluating; they must guide students’ process of inquiry by their own example. Students are not likely to break the constraints of concurrent pedagogical practices without the teachers’ epistemic guidance (Hakkarainen et al., 2004). A crucial condition for knowledge advancement is the creation of the same kind of social practices that characterize innovative knowledge communities (Hakkarainen, Paavola, & Lipponen, 2004). These characteristics involve autonomy and self-regulation rather than external regulation of learning processes: multivoicedness, diversity, and associated "creative chaos" rather than pre-structured and strictly controlled instructional processes without any degree of freedom.

As mentioned above, knowledge-creating inquiry can be facilitated by using networked environments that allow the participants to post their ideas and thoughts into a shared space and engage in many kinds of collaborative reflections and discussions. The progressive inquiry model has been implemented in the design of three generation of Future Learning Environment (www.fle3.uitah.fi; Muukkonen et al., 2005); this open-source based groupware environment provides support for participation in different aspects of progressive inquiry. Interested researchers and teacher practitioners can download it to their own server.

Some criticisms of the approaches are in order. The knowledge-building framework has significantly shaped concurrent research on learning communities in general and technology-mediated collaborative learning in particular. It provides sophisticated theoretical principles as well as practical guidelines concerning implementation of classroom learning communities aimed at collective knowledge advancement. There appear, however, to be two basic weaknesses associated with the knowledge-building approach (Hakkarainen, 2009). Firstly, the role of teachers is both under-theorized and under-investigated by the researchers of the knowledge-building approach. Experiences of knowledge building research indicate that the teacher is the heart of knowledge building, guiding, coaching, and orchestrating students’ inquiry processes, Bereiter and Scardamalia focus almost exclusively on analyzing and explaining students’ activities, leaving the role of teachers as a black box. When newly involved teachers try to implement knowledge-building culture in their classrooms, they may become discouraged when students initially fail to pose meaningful questions, generate relevant intuitive theories, or engage in productive discourse interaction (compare Hakkarainen, Lipponen, & Järvelä, 2002). Many intended knowledge building experiments neither facilitate genuine inquiry nor demonstrate knowledge advancement. In accordance with the DE approach, successful knowledge-building cultures are usually based on single classes in which there is an exceptionally motivated and committed teacher. Advancement of local knowledge-building communities is because the teacher iteratively works to transform local classroom practices toward inquiry-based ones, involving students’ participation in collaborative knowledge building. By practically exploring various possibilities, getting rid of weaknesses, resolving tensions and disturbances, and promoting the desired characteristics, he or she is able to promote directed evolution of classroom practices (see a description of spontaneously formed expansive learning communities in the last section of this chapter). Such invisible work of teacher-practitioners should be analyzed so as to make knowledge-building experiments capable of being scaled up (Hakkarainen, 2009); this issue will be addressed at the end of this paper.
A second related weakness is an over-emphasis of conceptual or intellectual aspects of inquiry in comparison to material and social-practice related ones. The problem is that knowledge-building discourse focuses almost exclusively on ideas (see, for example, Scardamalia & Bereiter, 2006): “a dynamic systems explanation of conceptual growth posits (along with other kinds of interactions) ideas interacting with ideas to generate new ideas” (p. 104, my emphasis). Systematic knowledge-advancement efforts, highlighted by Bereiter and Scardamalia, play, indeed, a crucial role in creation of a genuine inquiry community. If there were, however, a series of practical activities in which idea improvement had little apparent involvement, one might be tempted to question, based on this approach, whether an educationally valuable process of inquiry took place at all; such an understanding is limited. Ideas considered as conceptual artifacts do, indeed, function as carriers of what we will call knowledge advancement, a broad term meant to embrace conceptual and material aspects, and which subsumes “knowledge building.” Although learning and intelligence should not be reduced to shared practices and social structures (Hakkarainen, 2003c) (as I am going to argue in the context of COP), it is essential to realize the constitutive role of social practice in creation of classroom learning communities. In order to understand the logic of implementing a knowledge building community within a classroom, one has to break the closed circle of ideas and make other kinds of interactions in general, and social practices in particular, a main object of inquiry rather than a side issue. These issues are important because knowledge building cultures could not at all be implemented without the material agency (Pickering, 1995) provided by a technology-enhanced learning environment (Knowledge Forum) that transforms intangible ideas to epistemic artifacts that can jointly be elaborated (Hakkarainen, 2009).

Communities of practice

The common denominator of DE and KB is focusing on school learning as a separated field of activity that is, at least to some extent, insulated from the surrounding society. For cognitive researchers, moving from laboratory to naturally occurring phenomena within a school environment already appeared to be radical enough. From research on everyday cognitions and anthropological investigations of aboriginal cultures emerged a novel approach to learning – situated cognition – at the end of 1980s. Rather than seeing learning as a process of individual knowledge acquisition taking place in a classroom, the emerging situated approach examined it as a process of socializing and growing up to a social community and learning to function according to its shared norms and values (Lave & Wegner, 1991; Wegner, 1998). Instead of simple knowledge transmission, learning was understood to involve a transition from peripheral to central or full participation in certain established activities; such a transformation involves a change in participants’ identity, transformation of their agency, as well as gradual appropriation of cultural-historically developed tools and practices. The present – COP – framework is multi-faceted theory in its own right rather than a specific pedagogical model; as a consequence, it has many educational implications that cannot be reviewed here. We will address only a few points that complement earlier examination concerning DE and KB.

Learning takes place within informal communities of practices (Lave & Wenger, 1991). A community of practice may be defined as a group of persons with particular skills or expertise who interact formally within an organization, or informally – but routinely – in
a type of network for shared pragmatic or knowledge-related goals. It is built around a shared enterprise or project that members of the community agree on, and for which they jointly take responsibility. Everyone belongs to several communities of practice at home, at school, in the workplace, and in the context of leisure activities. Individuals, however, seldom become aware of the existence of these informal communities, which do not have an official membership or standard patterns of participation (Wegner, 1998).

From the situated perspective, it is evident that in normal school classes there are numerous communities of practice at work, with which the students adjust to the demands set on them by the school environment (Phelan, Davidson, & Yu, 1996). By participating in educational practices at school, students soon learn what they should do and what they should not do. They are likely to learn that in school the teacher decides the work order, sets the questions and explains things. Often students only learn to carry out the learning assignments set for them, instead of seeking to understand things. Many unpurposeful practices of learning can, in fact, be understood to be ingenious methods developed by students to survive in a learning environment and to negotiate the demands and expectations that are set (Scardamalia & Bereiter, 1996; Perkins, 1992).

In her famous article “Learning in school and out” Lauren Resnick (1987) highlighted many features in which school learning differs from the learning in work places and other out-of-school situations. There are several contrasts between typical in-school and out-of-school learning: It is typical to rely on an individual cognition in school, whereas people share their cognitive efforts outside school. Further, pure mentation in school is contrasted with tool manipulation outside. Symbol manipulation typical of school may be contrasted with contextualized reasoning outside. Finally, generalized learning in school differs from situation-specific competencies outside. Because of these contrasts, it is obvious that learning experiences in schools coach students to cope with learning tasks typical of schools, but do not give sufficient strategies and skills for effective learning in the rapidly changing and often ill-defined situations of professional life.

Encountering of real-world complexity is one way of bringing classroom learning communities closer to requirements of the surrounding society. Marton and Trigwell (2000) argued that that in order to facilitate transfer of learning, it is essential to engage students in collaboratively solving complex and varying problems. Personal and collective efforts of creating, comparing, and assessing various solutions to challenging multi-faceted problems is likely to prepare the participants for solving unanticipated problems that they may encounter in the future. In this regard, the traditional approach to assimilating mechanical procedures of series of problems that diverge from one another only in their surface-level characteristics, is not at all equally effective. While such an approach is an efficient way of preparing to an examination in which the very same procedures are tested, it does not build competencies needed in the partially unforeseen future.

Project-based learning (PBL) is a pedagogical model based on situated cognition that has been developed by Krajčík and Blumenfeld (2006) and their colleagues since the beginning of 90s. The idea is to engage students in pursuing projects that involve complex real-world activities corresponding with those of professionals in general and experts in particular. The model has been applied at elementary and secondary-level science education as well as at higher education. It is introduced as a motivating and
engaging alternative to traditional textbook-based instructional practices. It is assumed that students achieve a deeper understanding of material when they actively construct their understanding by participating in project-based learning. The approach aims at facilitating learning by doing in terms of applying ideas in a meaningful context. The participants may work during the process with questions, hypotheses, and explanations. They may be engaged in developing their own ideas for pursuing real meaningful tasks that are important for the students.

The project-based approach highlights the importance of inquiry, active knowledge construction, engagement in situated learning, participation in social interaction, and use of cognitive tools. The process starts with a driving question (Krajcik and Blumenfeld, 2006) that is a conceptually central problem of curriculum, the pursuit of which the participants consider to be meaningful, relevant, and worthwhile. The process involves participating in authentic situated inquiries rather than mere school-like activities. Students, teachers, and other community members are engaged in various collaborative activities. The process is mediated by learning technologies that augment various aspects of the participants’ inquiries. The participants are guided to create artifacts and other tangible products for addressing the driving question.

Heterogeneous projects are, however, being categorized as representing project-based learning. Whatever meaningful educational or professional enterprises may be considered as a project, and, consequently, there are not adequate boundaries of the approach. There appears be a "lack of an overarching theory or model of PBL (p. 38). Lack of a universally accepted model or theory has resulted in a wide variety of project-based research and development activities.

“What seems to be needed is nothing short of a new theory of learning and instruction, a theory that will provide, on the one hand, principles for guiding authentic inquiry, knowledge construction (vs. transmission), and autonomous learning for students, and, on the other hand, models for designing efficient and productive (standard-based) projects, shifting responsibility to the learner, coaching without directing, and conducting performance-based assessment for teachers”. (p. 36)

There is not always deeper learning involved where concrete products have become too much emphasized in relation to epistemic ones. Project-based learning efforts are often short-term enterprises without inter-project evolution or meta-level learning of project-based activities.

The challenge of projects focused on solving authentic problems is to ensure a gain in well-structured theoretical knowledge and its meaningful integration with the skills of solving practical problems. One possibility for facilitating participation in expert practices is to create simulated environments in which classroom learning communities can work with complex problems. ICT can be used to mediate real-life problems in schools in a form which makes it possible to connect practical problem solving with the learning of theoretical ideas and general thinking skills. With the help of advanced virtual reality and modeling technologies, students may be provided with access to very rich and complex bodies of knowledge; highly complex phenomena can be transformed into an observable form. Although a virtual reality cannot provide an authentic experience of the reality, and much of the experts’ tacit knowledge remains unexplored, it can provide
experiences very close to an actual situation (Cognition and Technology Group at Vanderbilt, 1997). Through solving these kinds of problems with the help of teacher or adult experts, participants in classroom learning communities improve their ability to solve complex problems, deal with uncertainty, and learn to adopt practices of expert-like working with knowledge.

**Student-expert partnership**

From research on classroom learning communities have arisen various forms of student-expert partnerships and student-scientist partnerships for building connections between schools and various kinds of expert cultures and communities (Cohen, 1997; Feldman et al., 2000; Hakkarainen et al., 2004). This means breaking through the boundaries between schools and expert communities in a way that creates direct and indirect links between students and experts representing various fields. It is psychologically and pedagogically extremely important to bring schooling cultures into closer connection with cultures of professionals working in various fields of knowledge, and in this way to take a peek at their competencies. The significance of having contacts with domain experts arises from the process of learning to understand their tacit knowledge, practices and goals of solving problems and working with knowledge, as well as the values and identities they model for the students. Interaction with experts reveals to the students that experts are ordinary people who are very committed to their work and, in many cases, enjoy solving problems and working at the edge of their competence.

Such partnerships are critical because higher level cognitive competencies develop in close interaction with expert cultures and through participation in communities of practice (Lave & Wenger, 1991). From the basis of situated cognition, different projects have been created with various aims: connection to expert cultures; the construction of efficient learning environments, and the transfer of expertise outside of schools; and the realization of learning projects (Brown, Collins, & Duguid, 1989; The Cognition and Technology Group at Vanderbilt, 1997). The “legitimate peripheral participation” approach focuses on creating social structures that enable learners to participate in expert communities already at an early stage of their learning. The focus in peripheral participation is on learning ‘epistemic’ processes and collaborative activities in which experts are engaged during complex problem solving, rather than just on gaining practical skills. Therefore, this kind of process is called cognitive apprenticeship, to separate it from more traditional forms of apprenticeship (Collins et al., 1989). Optimally, a student is not only an object of instructional methods but an apprentice in a practical, expert culture, one who is able to gradually carry out more and more demanding activities in his or her field. Within this framework, an important aspect of growing up with an expert culture is the model provided by more experienced members and participation in more and more demanding activities.

From the perspective of in-depth learning, it is essential that a child adopt an expert-like role and engage in a process of progressive problem solving (Bereiter & Scardamalia, 1993) in a particular domain of knowledge. The present investigator’s studies found evidence that a large number of the students, most of them males, mastered ICT and were able to take responsibility for many kinds of expert tasks, such as maintenance of ICT at school or coaching their fellow students or teachers (Hakkarainen et al., 2000). Adoption of an expert's role was closely connected with networking, i.e., being in contact with
other persons interested in the domain or with professionals. Considering the pedagogical goals of the school, this expert functioning is very positive, and may also significantly facilitate development of academic skills. The fact that many students who are not experts in ICT were reportedly ready to take on challenging problems indicates that the educational use of ICT may encourage a larger number of students to set themselves more ambitious learning goals.

It supports the development of students’ expertise, if spontaneously formed networks between schools and expert cultures were deliberately supported in domains that are essential in relation to the cognitive goals of school. Information networks and networked learning environments provide one concrete method of bringing various kinds of authentic, expert knowledge into schools, as well as mediating direct student-expert communication: in such contexts are created virtual communities of distributed expertise (students-experts, teachers-experts, students-teacher-parents), and multiple forms of engagement within projects (see Brown & Campione, 1996; Brown et al., 1993). Examples of these projects beyond the well known ”GLOBE” and ”EARTHWATCH” are ”Aquanaut” (students participating in ocean research), CoVis (scientific visualization as support of learning), ”FeederWatch” (students observing bird populations), and ”Kids as Global Scientists” (students investigating local and provincial weather conditions). The ICTs that create flexible connections that are independent of location have been central in these attempts to bridge the gap between school and expert cultures. With the help of network-based learning environments, it is possible to offer tools, with which students can get in contact with various sources of knowledge and expert information in addition to ordinary course books and lecture material.

Various kinds of student-expert partnerships promise to provide new intellectual resources for human development. These links could be weak (e.g. observing discussions between experts, getting access to knowledge created by them) or strong (participating in some student-expert partnerships, becoming an apprentice) in nature. Novel networking linkages provide students with new information, perspectives, and expand their possibilities of action. They are likely to obtain new metaknowledge about different domains of knowledge that may facilitate the development of their long-term interests and open up new life perspectives. It is essential to support continuous or permanent collaboration between experts and schools, teachers, and students. Teacher networking is critical because only a teacher who has learned to extend his or her pedagogical and intellectual resources though networked activities can understand the value of a networking student.

A good example of a working teacher network can be found in the city of Espoo (Finland). A group of 12 elementary schools worked for several years on developing new ways of using ICT in education, and relied on intensive mutual networking. The schools built a www-based journal and formed discussion groups. As a product of the collaboration, there emerged a new virtual learning environment, MATILDA, for teaching literature. This environment supports both students’ discussions and publication of their literature reviews that can be searched on the system's database. In the course of the projects, the teachers have been developing their expertise through networking with experts, such as writers or researchers. MATILDA facilitates teacher collaboration by providing a communal calendar of joint activities and helping participants to share good
instructional practices. Within the framework of the projects, the participating students not only produce evaluations of books they have read for the database, but also have opportunities to meet writers in various face-to-face meetings and discussions. The project has been scaled up to the national Netlibris (www.netlibris.net) projects coordinated by the Finnish National Board of Education (Frantsi et al., 2001).

In a series of investigations, we used Knowledge Forum for sharing experiences of various cultural activities, diverging substantially from conventional within-classroom inquiry processes. For example, we documented visually (background pictures) and conceptually (text notes) (a) encounters with experts, (b) results of field studies, (c) student-designed exhibition, and (d) design of concrete artifacts created by the students (Kangas, Seitamaa-Hakkarainen, & Hakkarainen, 2007; Seitamaa-Hakkarainen et al., 2004; Seitamaa-Hakkarainen, Viilo, & Hakkarainen, in press). In one of the investigations, the participating grade six students were, in an apprentice-like way, engaged in architectural knowledge practices. Students worked in teams and went through many of practices involved in actual architectural design. The participants were assigned a real building site from suburb of Helsinki. In accordance with the knowledge-practice perspective, they took part in field studies at the construction site, analyzed design of houses and apartments in their environments as well as helped design houses for specific purposes in their teams. The participant engaged in hybrid knowledge practices, for example, carrying out various concrete and material as well as epistemic and conceptual activities, such as taking measurements, doing calculations, reading and writing, sketching and drawing, and prototyping (making and testing scale models). The virtual and conventional learning environments enriched one another: Photos of the construction site, scanned architectural drawings, and photos of scale models were imported as background pictures to Knowledge Forum; as mentioned above, this learning environment supports visual organization of knowledge. Thereby, material activities taking place in socio-cultural environment, the participants’ conceptually driven inquiry, and technology-mediated activities reciprocally supported one another. Moreover, the students worked under guidance of a professional interior designer who was personally, both in talking and in terms of shared pragmatic activity, able to convey many aspects of architectural practices to the students. In the present case, the students were intensively interacting with the professional over a 12-week period.

The activities in which students are engaged need to be “expansive” or developmental in nature; instead of focusing merely on practical data collection, students should also be guided to take part in designing investigations and generating their own questions and theories about the issues being investigated. From educational perspective, it is essential that these activities facilitate participation in an in-depth inquiry; optimally, in addition to collecting data, students are responsible for its analysis, explanation, and interpretation. In any case, the students benefit immensely from functioning in the role of an investigator, having direct contact with researchers, and collecting information for non-authentic investigations. Such activities are valuable not just for epistemic but also motivational reasons. Although the student-expert partnerships take place in science studies, there are no solid reasons for not using participation approaches in other fields of inquiry as well. Mary Kellett (2005) and her colleagues emphasize, however, the importance of children themselves having ownership of such inquiry processes taking place in interaction with experts. It is essential to consider students themselves as active
researchers and listen to their own voice rather than subsume their inquiries completely under expert-driven research agenda. [The real world doesn’t let one ‘define’ one’s preferred problems, or allow one independently to decide to work on what interests him.}

The community of practice framework provides valuable guidance in rethinking educational practices in respect of breaking boundaries between educational institutions and the surrounding society. By pursuing complex problems and engaging students in collaboration with various expert communities, practices of learning and instruction may be transformed toward those of expert communities. Nevertheless, there are substantial difficulties in implementing authentic contexts in practice within the frames of institutional educations. Due to the restrictions of classroom teaching, it is very difficult to bring meaningful activities from the external world into the learning-instruction process. Finding authentic situations that can be integrated with institutionalized studies may be very hard.

Results may be less than optimal: Although engaging students in solving real-world problems and pursuing challenging “messy” projects may provide valuable educational experiences, experience as such is a very poor and insufficient "teacher." Practical projects carried out in the school context frequently fail to improve the students' conceptual understanding or higher level skills, the educators' original aim. Many prevailing pedagogical approaches appear to assume that practical activities and practical experiences as such would suffice to facilitate students’ learning. Bereiter (2002) argued that it is a serious fallacy to assume that these hand-on activities, or naively understood “learning by doing,” would produce desirable educational virtues. He proposed a principle that we will call ‘Bereiter’s Razor’ (Hakkarainen et al., 2004), according to which students learn from practical activities only those things they practice. He argued that all educational activities should be justifiable on their own, not by referring to overly optimistic, transfer results. The cognitive value of practical activities appears to depend on the role of these activities in the overall educational activity. It is essential that participation in concrete activities not be treated as an end in itself, but subsumed under higher-level goals that include reflection and advancement of knowledge and understanding (Roth et al., 1997).

Expansive-learning community

Relying on the Cultural Historical Activity Theory (CHAT, Engeström, 1987; Engeström, Miettinen, & Punamäki, 1999), Yrjö Engeström and his colleagues have investigated classroom learning communities from the perspective of expansive-learning. Activity theory provides conceptual tools for understanding social practices in education and workplaces and addressing the larger processes of socio-cultural transformation in educational contexts (Engeström, 1987; 1999a). Rather than examining school learning as its own sphere of human conduct, activity theory addresses historically changing relations between educational and other activities students take part in.

A cornerstone of the CHAT is an assumption that social practices rely on dynamic activity systems, deliberate transformation of the latter being a necessary condition for development. The theory of the ‘activity system’ (Figure 1) is based on a few central points: the object-orientedness of human activity, mediation through cultural-historically developed tools of activity, and contradictions emerging between the elements of activity
systems. It conceptualizes and identifies the crucial variables in the process. A collective activity has its own motive under which individual actions are subsumed and which they serve according to division of labor and communal rules. Doing new things is difficult both for individuals and their communities, but necessary when practices embedded in the activity system are not sufficient for solving and conceptualizing contradictions arising within the system or in relation to its environment. Engeström (1987, p. 174) defined the collective zone of proximal development (ZPD) in terms of differences between the community’s prevailing practices and the societally most advanced practice that can be generated as a solution to challenges encountered in the everyday practices. Expansive learning is learning that significantly broadens the scope of activity by overcoming limitations and challenges reflecting deeper contradictions embedded in an activity system. This may take place through addressing spatially and temporally expanded objects, transforming tools, or interconnecting several activity systems (Engeström, Puonti, & Seppänen, 2003).

Figure 1. A model of the activity system (Engeström, 1987)

Activity systems are conceptual tools designed to assist workplace communities in expansive learning by making visible, reflecting on, and transforming social practices. Toward that end, activity theory diverges from other practice-based approaches in respect of highlighting parallel conceptualization and constructive facilitation of social transformations. According to Engeström (1987), expansive learning starts by criticizing, questioning, and analyzing existing practices. Engeström’s theory focuses on dialectical tensions, contradictions, and conflicts within communal activities; these are usually ignored and considered nuisances by other approaches focusing on immediate empirical generalizations. Engeström (1999b, pp. 383-384) provides model of an expansive learning cycle. The model starts by 1), individual subjects questioning and criticizing some accepted practices, which is followed by 2), analysis of the situation, i.e., analysis of those (historical) causes that have led to the situation in question, followed by 3), modeling of a new solution to the problems, and 4), examining the new model by experimenting and seeing how it works, and what potentialities and limitations it has. Next is 5), implementing the new model in practical action and applications, and 6) reflecting on and evaluating the process. Finally there is 7), consolidating a new form of practice. Engeström’s model is to be understood as an ideal or heuristic for analyzing different elements in an expansive learning cycle rather than as a claim that these steps universally follow one another in lock-step. A central role is the process may be played by practice-driven construction of novel conceptions of learning and schooling; from activity-theoretical perspective DE, KB and PBL may be considered as new concepts of
organizing classroom activities that may guide envisioning of the participants’ (researchers, teachers, and students) future activity.

Engeström, Engeström and Suntio (2002) carried out a change-laboratory intervention (Engeström, Virkkunen, Helle, Pihlaja, & Poikela, 1996) with a teacher community of upper-primary school. During the intervention, the workplace communities reflected upon their prevailing practices by relying on “mirror” material (i.e., videotaped everyday practices of school) (compare Engeström, 2007). The participants analyzed the historical development of their current activity system and its inner contradictions, as well as envisioned and implemented (through practical experimentation) a new model of the activity. These collaborative reflections were triggered and guided by the researchers, who collected ethnographic data on local educational practices. The intervention took place across several stages that extended over three years. The project was conducted in a primary school of Helsinki in which there were a large number of socio-economically disadvantaged youngsters.

A special focus were the challenges emerging from knowledge work that highlight the importance of pursuing complex problems and require integration and synthesis of knowledge across disciplines. According to the analysis, there are several factors that make pedagogical transformation of a school very difficult, factors such as the social, spatial, and temporal structures embedded in classroom-based studies (study of autonomous texts for exams and grading), and the teachers' tradition of working as individual professionals. These fundamental constraints may make it very difficult for participants to collectively reflect on their practices and engage in exploring possibilities of transformation through asking questions, generating models and artifacts, and testing and experimenting with new practices. The change laboratory focused on making constraints visible to the participants and helping them to surpass these constraints. The intervention helps to identify developmental challenges to the activity system of the

Figure 2. Expansive learning cycle (Engeström, 1987)
school, collectively constructing a vision of the school's future, and implementing a series of practical changes. One of the pedagogical decisions made by the teachers was to organize students’ collaborative end-of-school project during which they have to integrate knowledge and understanding across multiple disciplines as well as engage in field work.

Figure 3 presents four ideal typical conceptions of school based on two dimensions of expansion of the traditional school (Engeström, Engeström, & Suntio, 2002). The first addresses the nature of problems solved and the second relations between school and the surrounding society. Across the first dimension, there is a trend from solving curriculum-related problems to pursuit of complex real-life challenges. The former vary from textbook problems for which the right answer to more complex knowledge problems embedded in the curriculum. The latter may involve various kinds of practical concerns varying from simple tasks to deeper societal concerns that often do not have predetermined correct or justifiable solutions. The other dimension involves transformation from a school that is isolated from society toward a school that is embedded in a close collaboration with the surrounding community. In traditional schools, knowledge is considered to consist in autonomous texts (Olson, 1977) that the participants are expected to directly assimilate. Strict division of labor between teachers artificially fragments available knowledge to separate subject domains that appear to have very little to do with one another. Such biases, which easily corrupt students’ motivation, are strengthened by relatively isolated schools that are separated from and have little collaboration with the surrounding society.

From the perspective of the cultural-historical activity theory, in contrast, the objects of learning are cultural-historically evolved epistemic and practical tools that are inseparably integrated with human practices. While situated cognition tends to reduce learning to situated practices and disregard the importance of conceptualizations, the CHAT highlights importance of parallel transformation of practices and conceptualizations. Breaking the boundaries between school and external communities allows taking critical collective problems and strategic societal challenges as objects of investigations that are addressed using available cultural-historically evolved tools and instruments.

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2 I am grateful for Professor Jaakko Virkkunen for making me aware of the importance of this distinction.
Figure 1. Two dimensions of expansive school transformation. The upper right (sector 4) indicates the direction of the schools’ technology enhanced collective zone of proximal development (Engeström, Engeström, & Suntio, 2002).

Sector 1 represents the traditional school in which teachers’ work has been defined by domain-specific pre-determined curriculum packages, formal teaching models with rigid stages, and utilization of various standardized school achievement tests. Sector 2, in contrast, represents pedagogical models, such as project- and problem-based learning, which aimed at making the traditional educational practices more meaningful by means of engaging students in solving complex real-life problem without, however, truly breaking the received frame of educational activity. Sector 3 represents approaches that address classroom learning communities focused on collaborative building and sharing of school-based knowledge by relying on technology-enhanced learning environments. Both Brown’s distributed expertise and Bereiter’s knowledge-building approach may be regarded to represent this sector as far as those are oriented toward pursuing central curricular topics in collaboration with domain experts. Simultaneously, it should be taken into consideration that these approaches may also be focused on addressing complex real-world problems so that some cases come closer to sector 2 than 3. It was both Brown’s (1997) and Bereiter & Scardamalia’s (2006) intention, respectively, involves students in “thinking and learning of serious matters” and bringing “real ideas and authentic problem” to school.

By combining the two dimension of expansion, sector 4 defines the collective zone of proximal development of school. While some of these lines of expansive development of school have been pursued before, there has seldom been a systematic and deliberate effort to explore trajectories of school development at the collective ZPD related to sector 4. In such a school, learning is, to a significant extent, carried out by solving real-world
problems in contexts that cross-fertilize educational and professional activities. This approach involves schools becoming contact zones between two or more social communities that encourage the participants to share ideas and cross-fertilize their social practices (Tuomi-Gröhn & Engeström, 2003). Such practices may involve extensive fieldwork, interaction with local professional communities, or collaborative projects involving heterogeneous stakeholders (Hakkarainen et al., 2004; Yamazumi, 2006; Roth & Lee, 2007). It is psychologically very important to distance oneself from everyday practices, give up inflexible and rigid routines and taken-for-granted practices, and engage in interaction outside boundaries of one’s own practice field.

When the classroom learning communities are examined from such an expansive perspective, it is necessary to initiate projects in which school children actually collaborate with various external communities, rather than merely simulate such activities. While pursuing learning communities that integrate school and society, Roth and Baron (2004) have developed a novel approach to science education. They argued that we need to rethink scientific literacy as a capacity to take productive part in solving of the strategic challenges of our time, such as protection of the environment and survival of the Earth. From their perspective scientific literacy is not only in capacity of applying scientific concepts and procedures for successfully solving textbook problems but embedded in capacities of using, utilizing, and extending scientific knowledge while solving complex real-world problems in collaboration with cultural communities of the surrounding society. Roth and his colleagues have pursued a project during which students take part in protecting local waterways in collaboration with native communities of British Colombia, Canada. Accordingly, student take part in collecting and analyzing samples, improving river bends, and reporting results in meetings of local environmental activists. Experiences of taking part in such rich social and cultural processes are likely to elicit identity transformation and growth of the participants’ agency. Their activities have deeper meaning and cultural significance that goes much beyond regular concerns of individual school achievements or a separate school project. According to Roth and his colleagues, many students who do not show any visible promise within school class, start shining and sparkling ideas when engaged in a completely different type of educational activity involved in social movements. Citizen Memory project mentioned above appears to have similar characteristics and go, in this regard, beyond curriculum-driven knowledge building.

While taking part in such expanded activities students are likely to enact practices different from schools and, thereby, are able to adopt multifaceted novel roles. An expanded school allows fostering the development of students’ agency in a way that elicits productive participation in cultural communities in question. It appears to me that best practices of distributed expertise, knowledge building, and student-expert partnership share some of the characteristic of expanded school. Nevertheless, it is a limitation of these approaches that there is a tendency to examine educational activity as a hermetic sphere of its own; they leave relations between educational and other activities as a black box, and reduce expansive potentials of student-expert partnerships to relatively narrowly interpreted educational objectives. {odd place for criticism}

Cultural-historical activity theory takes the institutional aspect of schooling seriously. While the other approaches reviewed took the institutional frame of education as given
(distributed expertise; knowledge building) or focus on prevailing educational and professional practices (community of practice), the expansive learning approach deliberately addressed historical transformation and dynamic development of school. This approach took on historically novel challenges of learning and instruction as well as challenges of associated pedagogical transformations. Focusing on organizational learning nicely complements the earlier approaches. From the perspective of an individual teacher, this approach that calls for a whole teacher community’s involvement may, however, be very demanding. Rather than addressing challenges of individual learning than a teacher may struggle with, the specific focus of the approach is on modeling social transformation involved in school development. The methods of developmental work research that expansive learning calls for appear also to require external guidance and support. On the other hand, this approach appears to provide novel possibilities of deliberately mastering educational transformations; to certain extent it could be appropriated by a teacher interested in transforming social practices prevailing in his or her classroom. While the CHAT perspective has not yet provided as extensive research on classroom learning communities as the other three frameworks (see, however, Roth & Lee, 2007), it appears to have a great deal of promise in this regard.

Concluding remarks

The educational value of classroom learning communities

Educational researchers, according to David Olson (2003), have often attempted to derive needs of educational reform from theories of individual learning, disregarding almost completely institutional aspects of schooling. As Olson (2007) strikingly pointed out, “Yet, even if an improved understanding of learners is possible, it is not clear that such knowledge, generated by the best research, will have an impact on the practicalities of schooling. … Schooling is an institutional practice that has been shaped up to meet a number of social constraints, and it is willing to take on board only those initiatives that affect the achievements of their mandated goals, including higher scores on specified tests” (p. 92). The notion of classroom learning communities appears, however, to expand the repertoire of educational research by means of addressing community-oriented aspects of learning. Such an approach has a potentially significant impact on school transformation.

What kinds of outcomes have experiments concerning classroom learning communities produced? Some investigators are following the lead of medical studies and promote evidence-based educational research so as to know “what works” in education (Slavin, 2002). The problem with experimentally controlled educational studies regarding classroom learning communities is that many aspects of such interventions are not yet well understood (cf. Olson, 2004). Radically local cultures embedded on social practices cannot be adequately and simply investigated by abstracting individual features and characteristics across communities, schools, and cultures; such de-contextualized information could not be easily utilized in improving practices of specific classroom learning communities. On the other hand, learning of core skills and competencies determined by the curriculum is essential, and systematic studies of educational achievements provide relevant information in this regard. While educational outcomes of classroom learning communities have not been systematically investigated due to the local and heterogeneous nature of interventions involved, published reports provide
encouraging evidence according to which such experiments provide equally good or better results in conceptual and procedural skills than traditional educational practices (Lamon et al., 1996; Brown & Campione, 1994; 1996; Scardamalia & Bereiter, 1999; 2006).

Moreover, classroom learning communities promote hard-to-nail-down transformation of classroom cultures and change in the participants’ identities and agency. Such communities involve transition from pursuing well-defined textbook assignments with pre-determined right answers toward pursuing complex problems with various kinds of more or less creative solutions. As mentioned above, the variation concerning learning tasks pursued by the participants determines the subsequent transfer (Marton & Trigwell, 2000). Students who have independently and collaboratively learned to propose and evaluate solutions to varying complex problems are better able to solve novel unanticipated problem in comparison with students trained to solve similar kinds of problems by relying on mechanical procedures. All of the approaches to classroom learning communities, in some manner, focus on bringing more complex kinds of problems to the classroom. Perhaps the cognitively inclined approaches of Brown and Bereiter highlight the conceptual complexity of various domains of knowledge whereas socio-culturally oriented approaches foreground real-world complexity rather than knowledge prevailing in textbooks.

Promoting collaborative practices of the classroom learning communities

In what follows, I will address some ideas and experiences that have emerged while reflecting on and implementing classroom learning communities at the elementary level education (Hakkarainen et al., 2005). Various kinds of projects structure the activities of classroom learning communities (Krajcik & Blumenfeld, 2006). Although individual teachers may organize their own projects, it is beneficial when there are teachers’ multi-professional projects aimed at facilitating students’ collaborative inquiries. Organizing work in such a project allows the participants to integrate learning across disciplines and muster students’ efforts across several weeks and months for in-depth investigation of relevant issues. The themes of the project organized may vary from addressing central curricular contents to organizing events and practical activities, and from within-school projects to ones involving multiple stakeholders. Learning to carry out projects is important because pursuing an evolving network of projects appears to be the way human creative activity is organized in general (Gruber, 1981).

A well-structured approach to collaborative learning is needed because many teachers and students have negative experiences of collaborative learning. Everyone remembers group works in which some individual student held all the responsibility, and it remained unclear what the student community learned about such an effort in the end. There are things which we have learned through experience to do much better on our own than together. It may be necessary to cultivate collaborative knowledge practices because it is not self-evident how to productively merge and fuse epistemic efforts. If individual performance assessment and the more or less open competition between students is common in the classroom, collaborative methods may at least initially lead to a weakening in performance. Both the teacher and students require the experience of using various collaborative methods, adopting various socio-cognitive roles, coming up with a functional division of intellectual labor, before collaboration will begin to produce good
results. Even if teachers value collaboration and ICTs offer good opportunities for it, the students are not likely to be able to use these opportunities productively without support and guidance. Building a culture of collaborative learning requires systematic efforts and cultivation and the re-evaluation and transformation of prevailing practices. Certain useful practices of collaborative learning are examined in Table 2; capitalizing on corresponding practices assists in creating a productive classroom learning community.

In addition to practical arrangements and competencies, collaborative learning requires the creation of a shared object for working and the setting of distributed tasks which support it (Brown et al., 1993; Hakkarainen et al., 2004). Object-orientation refers to the organization of a learning community’s action around some shared project or venture. Hakkarainen and his colleagues argue that collaborative learning is not only about dialogic interaction between students; it aims at pursuing a shared object of activity (Paavola, Lipponen, & Hakkarainen, 2004). They call such activity “trialogical” in nature because the shared object mediates their activities and structures their sustained collaborative efforts (Paavola & Hakkarainen, 2005). There objects could be epistemic entities (research problems, working theories or pieces of knowledge), designed artifacts (prototypes, concrete products), joint events (e.g., exhibitions), or pursuits of societal challenges. As the project progresses, this kind of a shared object may change and get new more precise meanings.

Common awareness about the shared assignment of the learning community can be kept up with the help of classroom discussions. In collaborative classes, the students regularly work in groups, and joint inquiry can be supported by a shared screen which is projected on the wall (or by using a smart board), in which shared works can be presented and pondered and which assists in sharing the research results of all student teams. Joint discussions in front of the shared screen may be supported by a networked learning environment; such environments provide a shared database for which the participants may produce knowledge.

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>Temporal and spatial organization of activity</td>
<td>Re-organizing and re-structuring learning environment in a way that makes collaboration a natural, routine, and productive aspect of a classroom’s and school’s activity</td>
</tr>
<tr>
<td>Systematic practice of group work</td>
<td>Deliberate training of good practices of group work, such as moderating discussions, sharing tasks, planning collaborative work, learning from others and providing assistance to the others.</td>
</tr>
<tr>
<td>Group formation</td>
<td>Forming heterogeneous groups consisting of students with complementary knowledge and skills in order to achieve something that the participants could do alone.</td>
</tr>
<tr>
<td>Object-orientedness</td>
<td>Setting up a higher-level epistemic objective as the basis of collective activity. It could be a higher-level problem or challenge solving of which the participants build knowledge or achieving of which they are jointly working (e.g., an exhibition).</td>
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<td>---------------------</td>
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</tr>
<tr>
<td>Shared tasks</td>
<td>Putting students into a situation in which they have to engage in intensive interaction and collaboration, in order to succeed.</td>
</tr>
<tr>
<td>Distributed expertise</td>
<td>Creating internal division of labor within a learning community that guides the students and their groups to cultivate expertise concerning certain topics representing the subject domain in question. Encouraging students to acquire expertise of relevant topics and sharing it through reciprocal teaching.</td>
</tr>
<tr>
<td>Collaborative hot-spotting</td>
<td>Integrating once in a while collaborative and personal learning activity. This can be done by giving the whole classroom a task related to challenges concerning an individual student team so as to assist everyone to acquire corresponding expertise. This means an effort to make the whole learning community to pulsate in the same amplitude.</td>
</tr>
<tr>
<td>Distributed regulation of inquiry</td>
<td>Following and supporting students’ group work by encouraging and guiding them. This task can be carried out by the teacher or the students. In the latter case, some students are assigned the special task of facilitating collaborative work. They can be asked to follow that all are sufficiently involved, do their part of the learning tasks, and have their voices heard.</td>
</tr>
</tbody>
</table>

Distributing expertise does not always produce the best results; consequently there is reason, once in a while, for the whole learning community to study some particular problem or epistemic domain (Hakkarainen et al., 2005). In this case, the expert groups temporarily suspend their action and everyone focuses on solving a joint assignment. This method may be called ‘collaborative hot-spotting’; it is aimed at mustering the epistemic resources of the entire learning community to solve a single group’s problem or challenge. Collaborative hot-spotting means that collective and personal work are combined from time to time. This may take place, for example, in by means of giving the students’ some common problem in order for all participants to become familiar with an important subject area concerning the project being pursued. This method assists in bringing everyone up to the same level of knowledge required by the distribution of expertise, and in this way helps the whole learning community work at the same pace.

Although the distributed-expertise projects aim the development of cognitive activities, the limitations and constraints of the process are often related to social activities and
emotions (Hakkarainen et al., 2005). If a competitive culture prevails within a classroom, students may be afraid of unavoidable mistakes and fear failure in front of their peers. Such a situation may hinder and constrain their participation in distributed inquiry. In order to overcome such challenges, it is essential to create an atmosphere which creates trust and develops practices of constructive feedback. Accordingly, the students may be guided to ask each other to explicate and clarify their ideas rather than directly criticize evolving knowledge during the inquiry process. Classroom learning communities should be “safety zones” in which the students are provided a gift of confidence concerning their abilities to genuinely contribute to collective inquiry (Mahn & John-Steiner, 2002). The emergence of such a community is likely to require deliberate and sustained efforts of the teacher(s) rather than take place spontaneously.

One of the objections that has arisen in relation to the community-centered approaches to classroom learning communities is that only high achieving students are able to take part and learn from self-organized collaborative inquiry practices promoted by the present approaches. This concern has to be taken seriously. There are large differences between students’ cognitive abilities due to heterogeneous social, cultural, linguistic, and financial resources of their families in which intellectual socialization takes place. Constant assessment, competitive relative grading of student achievements, and repeated selection of students to different educational track take place at school. This process is likely to empower, mainly, academically high achieving students and make other students feel inferior and perform less than optimally. Knowledgeability of students coming from socio-economically advantaged homes is recognized by prevailing educational practices, whereas knowledge and competence of the others are disregarded or underestimated. Many of the participants experience school knowledge as irrelevant and, as a consequence, experience severe motivational problems.

Experiences of teachers I have been working with indicate that students suffering from learning difficulties have been able to take productive part of inquiry projects organized by relying on DE and KB. They may, however, require specific attention and assistance from the teachers. There are some indications that in certain experiments high achieving students are producing most of the content as well as showing tremendous levels of learning. Simultaneously it appears that personal experiences, cultural values or everyday concerns of many of the weaker students are not acknowledged at school. Participation in such narrow educational practices provides only minimal opportunities for expansive learning. Consequently, experiences and processes of taking part in genuine communities, networks, and social movements outside of school may play critical role in human learning and development. Moreover, it is essential to allow students to build on their strengths, provide many paths to common educational objectives, and tailor rehabilitation efforts according to specific characteristics of students (what he or she knows and does not know, understands and does not understand) (Clay, 1998; Olson 2003). {a bit vague; so the less advantaged are to find fulfillment outside of school?}

**Deliberate mastery of educational transformation**

Naive approaches to student-centered, “constructive” learning sometimes give an impression that such approaches can be implemented by giving students freedom to pursue their own inquiries. The reality could not be farther from the truth. My experience indicates that the teacher is almost always the heart and soul of classroom learning
community. Learning communities with a meaningful pedagogical agenda do not emerge without the teacher’s systematic efforts, taking place in collaboration with fellow teachers and the students. A great deal of systematic preparation is needed in order to create a basis of inquiry processes within and beyond the school. In order to be able to guide and direct the students’ inquiry, he or she may need to learn to master a large body of knowledge going beyond his or her former professional training. While the teachers may need to stay in the background so as to give space for student-driven activities and efforts, it is essential to continuously monitor what is going on and intervene when necessary. A classroom learning community provides a general frame for students’ collaboratively oriented inquiry process; this allows them to collaboratively tackle challenging projects and pursue collective objects they can be proud of. Such a macro context of classroom activity structures activities across relatively long periods of time (one or several semesters); it does not, however, replace systematic, teacher-led efforts of instruction. Whenever there is a central issue that the students do not appear to understand, the participants appear to lack relevant procedural skills, or advancement of inquiry is prevented by epistemic obstacles, the teacher should interrupt all activities, address the issues together with students, and, when appropriate, directly teach whatever is needed. Implementation of a classroom learning community has involved rethinking learning in connection with community activities, but it is not in conflict with providing lectures or courses on topics that the teacher knows and is enthusiastic about.

Pioneering efforts of such psychological researchers as Brown and Bereiter and Scardamalia transformed the traditional views according to which learning is an individual and mental process. Parallel pursuit of innovative pedagogical approaches and technology-enhanced learning environments has provided instruments for significantly improving the quality of education. These approaches appear, however, to be limited because they, at least partially address, classroom learning communities as separate from the surrounding society. Although field studies or student-expert partnership may play a central role in concrete implementation of these approaches, it appears to be characteristic of cognitively-inclined approaches to examine classroom learning communities as if these constitute their own self-sufficient universe encapsulated from the social and cultural environment. It has been proposed that the added value of socio-culturally oriented approaches, such as Lave and Wegner’s (1991) communities of learning approach and Engeström’s (1987) expansive learning approach, is in questioning the boundary between classroom learning communities and other social activities in which the students take part in, as well as in examining the constitutive role of social practices in education.

From an assumption that social practices play a crucial role in learning follows the importance of creating connections between classroom learning communities and communities outside of school. While it is difficult to become aware of outside social practices while staying inside of one’s community, these become apparent when crossing boundaries, moving across communities, and engaging in genuine cultural activities that bring developmental transfer about (Tuomi-Gröhn & Engeström, 2003). Such processes may be socially and emotionally burdening, but worthwhile in respect of participants learning to appropriate various aspects of experts’ practices. It appears that creating concrete trails between cultural communities assists in making corresponding epistemic trails and undergoing corresponding epistemic shifts (Cussins, 1992). Beyond student-
expert partnerships, it may be essential to provide students opportunities to take part in extended working with experts.

While the above reviewed four perspectives on classroom learning community rely on different views of learning and community, their pedagogical approaches are not, in practice, mutually exclusive. It is common for teachers to integrate in their classrooms both elements of DE and KB. As mentioned before, the Schools for Thought project intentionally aimed at integration of these two pedagogical frameworks. If cross-fertilization of practices between educational and various cultural communities, is the specific focus of COP and LE, it may also play an important role in pursuits related to DE and KB. In spite of their inclinations toward cognitivism, the latter two approaches acknowledge the importance of social practices, implicitly if not explicitly. Activity structures promoted by DE (jigsaw method) and knowledge-building principles (Scardamalia, 2002) highlighted by KB represent characterization of social practices involved in the collaborative inquiry learning process.

Educational researchers often address classroom learning communities as pedagogical ideals and appear to assume that educational transformation takes place when teachers understand the pedagogical principles of the functioning of those communities. In reality, educational practices are extremely difficult to change (Olson, 2003; 2007). This is because both the teacher and the students function according to experience-based and partially unconscious habitus (Bourdieu, 1977; see also Roth, 2002). Those activities that are in accordance with the habitus are easy to carry out whereas the participants feel like fishes outside of water when trying to engage in activities not supported by the habitus. All of the pedagogical approaches addressed in this paper, such as DE, KB, COP, and EL, call for transformation of social practices beyond belief revision. Successful inquiry cultures are created in classrooms in which teachers, together with students, have cultivated classroom practices that channel the participants’ efforts in a way that elicits in-depth learning. The quality of inquiry taking place within a classroom is determined by those practices that are related to working with knowledge (knowledge practices), i.e., searching and processing, creating, developing, and sharing of knowledge (Hakkarainen, 2003b; 2004). Also technology-mediated learning environments enhance learning only through transformed social practices (Hakkarainen et al., 2006). Only when participants’ tools and instruments are anchored in appropriate structures of classroom activities are increased learning achievements to be expected. It appears that frustrations of many teachers concerning promoting classroom learning communities are based on the fact that they are not aware of the requirement of iteratively transforming classroom practices rather than merely promoting associated pedagogical ideas (e.g., putting students’ ideas into the centre, Scardamalia, 1999).

The present investigator and his colleagues have argued that knowledge building, in fact, appears to be a special kind of social practice rather than represents mere playing with ideas (Hakkarainen, 2009). In order to make knowledge building work, a teacher has to create local practices within his or her classroom than channel the participants’ efforts in a way that elicits collective knowledge advancement. Advancement of local knowledge-building communities emerges through the teacher iteratively working to transform local classroom practices toward inquiry-based ones, involving students’ participation in collaborative knowledge building (Hakkarainen, Bollström-Huttunen, & Hoffman, 2008).
It appears that classrooms of such teachers are spontaneously formed expansive-learning communities in which novel practices emerge through iterative efforts that involve reflecting on weaknesses of prevailing practices, implementing and evaluating changes, and using the emerging best practices as a starting point of subsequent iterative efforts (Hakkarainen, 2003a; 2003b; 2004). By practically exploring various possibilities, getting rid of weaknesses, resolving tensions and disturbances, and promoting the desired characteristics, he or she is able to promote directed evolution of classroom practices. The process does not, of course, take place only in a top-down fashion from teachers’ guidance to transformation of students’ practices; it involves improvisational and dynamic coevolution between patterns of using shared instruments, knowledge objects pursued, and teachers’ and students’ activities. Successful knowledge-building cultures rely on gradual cultivation of knowledge practices that channel the participants’ epistemic efforts in a way that elicits knowledge advancement (Hewitt, 1996; Hakkarainen, 1998; 2003b, 2004). Needless to say, it would be beneficial for mastering of such processes, to be able to model the social transformation explicitly rather than implicitly and be reflectively aware of expansive learning cycles involved in the process.

It appears that the development of classroom learning communities has a dynamic of its own. Accordingly, innovative classroom learning communities cannot be created from scratch; this requires sustained iterative efforts in transforming social practices prevailing within classroom toward more innovative ones. A new teacher should not become discouraged if collaborative learning does not immediately provide expected results. While it may be difficult to change study practices of an already established community, it is possible to intellectually socialize novel student cohorts to advanced collaborative inquiry practices from the very beginning of their studies within a classroom (Hewitt, 1996; Hakkarainen, 1998; 2003b). It is also advisable to engage in multi-professional work with other teachers to create networks of classroom learning communities as well as promote corresponding transformation at the level of the whole school. This implies overcoming spatial and temporary constraints of prevailing activities by such means as multi-professional collaboration between teachers, integration of instructional efforts initially fragmented according to disciplines, and boundary crossing between the school and the surrounding society (Engeström, et al., 2002). When integrated with iterative efforts in improving and developing the community by overcoming challenges and tensions encountered in classroom practices, it is possible to get into an expansive developmental trajectory of prevailing knowledge practices. While COP and EL are grounded on social practices, the researchers of these frameworks warn implementers not to over-generalize abstract pedagogical models. Successful classroom learning communities are “radically local” achievements that cannot directly transferred to neighboring classes, not to mention other schools or countries (Hedegaard & Chaiklin, 2005). Such educational initiatives have their histories and rely on sustained efforts of cultivation.

The educational value of the classroom learning community approaches appears to be in facilitating the development of participating students’ agency and transformation of their identity (Hakkarainen et al., 2004; Engeström, 1999a). Participation in pursuit of complex collective projects in likely to elicit a students’ socio-cognitive growth. Breaking boundaries between school and cultural communities often provides opportunities for appropriating novel roles and developing one’s agency. Novel and more
demanding roles become available to students when engaging in extra-curricular activities taking place outside of the classroom. As mentioned above, it often happens that new groups of students start excelling when engaged in activities across multiple contexts. Epistemic agency in the form of assuming collective cognitive responsibility for collective inquiry efforts appears to be especially important (Scardamalia, 2002). From the socio-cultural perspective, learning is not, however, a mere epistemic improvement, but also an ontological transformation. Creating a safety zone allows utilizing errors and mistakes as collective learning experiences.

Moreover, it appears to me that the best practices of learning and instruction, including ones explored here, have emerged through interaction between teachers and researchers. Innovative teachers explore innovative practices of working with knowledge in their classrooms, often supported by technology-mediated learning environments. Often their work has been inspired by researchers’ approaches and pedagogical ideas. In many cases, however, teachers are able in practice to go beyond the ideas that were the source of original inspiration and invent new pedagogical practices through their practical pedagogical exploration. Researchers, in turn, may conceptualize this emergent phenomenon in a way that assists the teacher to identify key issues so that there is continuous co-evolution between pedagogical practitioners – teachers – and researchers. Such observations have emerged through my almost 15 years of participation in research and development of knowledge-building communities. Consequently, it is essential to facilitate closer interaction between teachers and researchers by creating hybrid cultures; in such cultures, both of these domains of expertise are cultivated and their growth alongside one another is encouraged. These collaborative processes enable the participants jointly to go beyond boundaries of the initial inquiry approach; in effect, they take that learning culture itself as the expansive object of an emerging, practice-driven educational process.

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REFERENCES


Figure

Setting up Research Questions

Creating the Context

Generating Working Theories

Critical evaluation

Distributed Expertise

Searching Deepening Knowledge

Generating Subordinate Questions

Developing New Working Theories