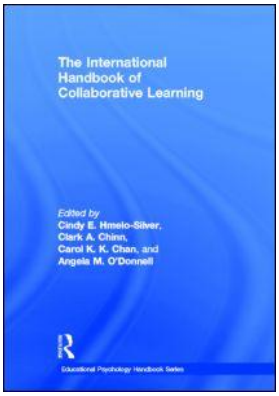

The International Handbook of Collaborative Learning

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Cultivating a Community of Learners in K–12 Classrooms

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III

Instructional Issues and Approaches to Collaborative Learning

13

CULTIVATING A COMMUNITY OF LEARNERS IN K–12 CLASSROOMS

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The goal of communities of learners (CoL) models is to foster deep disciplinary understanding—an understanding of both subject matter and the ways the disciplinary community works with knowledge in a domain. Through working collectively to carry out investigations, learners develop the agency and social capacities necessary for creatively working with knowledge. Such models require teachers and students to engage in new modes of inquiry that tend to be very different from the ways in which learning and teaching occur in more traditional classrooms. In fact, we have previously described this type of educational model as a "radical reconceptualization of educational practice" (Bielaczyc & Collins, 1999). Similarly, Bereiter (2002) claims "Students need to be socialized into the world of work with knowledge, and that is an even more radical cultural change than becoming 'digital'" (p. 220). Thus, we believe that one of the greatest challenges facing the implementation of CoL models concerns how to support the change processes that teachers and their students must move through.

The intention of this chapter is to collect together what has been learned in the educational community and in our own work with teachers concerning how to cultivate a community of learners. We discuss both key theoretical underpinnings (design principles, epistemology, and an understanding of how students learn) along with five key changes in the classroom that we believe provide the most transformational leverage in bringing CoLs to life in K–12 classrooms.

WHAT IS MEANT BY A COMMUNITIES OF LEARNERS MODEL

We describe what is meant by a CoL model by highlighting a particular family of models from the K–12 educational literature, followed by a description of what we see as the defining characteristics. We have chosen three specific lines of research to discuss in the present paper: Brown and Campione's fostering communities of learners (FCL) model, Scardamalia and Bereiter's knowledge building communities (KBC) model, and Lampert's model of mathematics classrooms. We also point interested readers to the work of Barbara Rogoff, who worked for years in the creation of a school based on a learning communities approach (Rogoff, 1994; Rogoff, Turkanis, & Bartlett, 2001). We do not include Rogoff's work here because we wanted to choose models that have focused on classroom-specific implementations within more traditional school settings, since we felt that this captured the circumstances that a majority of teachers interested in these types of models might themselves be faced with. Clearly, though, if an entire school community adopts a CoL approach, the overall environment better supports CoL classrooms.

Fostering a Communities of Learners Model

The FCL model was developed by Ann Brown and Joseph Campione and their colleagues in the early 1990s (Brown, 1992, 1994; Brown & Campione, 1996). According to Brown and Campione (1996), "FCL is designed to promote the critical thinking and reflection skills underlying multiple forms of higher literacy: readings, writing, argumentation, technological sophistication, and so forth" (p. 290). The FCL approach promotes a diversity of interests and talents in order to enrich the knowledge base of the classroom community as a whole. The overall structure of the FCL model involves students (a) carrying out research in a particular area of inquiry where individuals or small groups specialize in a particular subtopic area, (b) sharing what they learn with other students in their research group and in other groups, and (c) preparing for and participating in a consequential event that requires students to combine their individual learning, so that all members in the class come to a deeper understanding of the central topic and subtopics. Brown and Campione (1996) describe how the basic FCL structure of carrying out research *in order* to share information *in order* to perform a consequential task "should be viewed as a system of interacting activities that results in a self-consciously active and reflective learning environment" (p. 292).

Knowledge Building Community Model

The KBC model was created by Marlene Scardamalia, Carl Bereiter, and their colleagues in the early 1990s, and has been developing as one of the "longest running design experiments in education" (Bereiter, 2005–2006). The vision of classrooms as knowledge building communities is for students to build collective knowledge with "fidelity to the ways work with ideas is carried out in the real world" (Scardamalia, 2002, p. 6). "Advancing the frontiers of knowledge" is the central aim of the community. Students are meant to develop the "epistemic agency" to identify problems of understanding, create theories, carry out research and investigations in order to refine their theories over time, revise their problems and strategies, and share and monitor the progress of the community toward its goals. The KBC model is embodied in Knowledge Forum, a computer-based environment that allows learners to construct a communal multimedia knowledge base (Scardamalia, 2004). Ideas in the database are viewed as objects of inquiry that can be

tinkered with, combined with other knowledge objects, and improved upon (Scardamalia, 2002).

Lampert's Mathematics Classrooms

Magdelene Lampert taught mathematics in a Michigan fifth-grade classroom in the 1980s and 1990s, where she developed an approach to teaching that reflected her view of an idealized mathematics community (Lampert, 2001; Lampert, Rittenhouse, & Crumbaugh, 1996). The class usually starts with a problem posed to the students, which they work on alone or in groups, developing their solutions in notebooks that retain all their work during the year. Lampert encourages students to discuss different ideas and solutions, so that they develop a deep understanding of the mathematical principles underlying their work. Participating in the mathematical discussions, learning how to make mathematical arguments, and learning the language of mathematics (terms such as *conjectures* and *commutativity*) are the central activities in the classroom.

Although the three models each have distinct features (e.g., FCL is well-known for its system of activity structures based upon Vygotskian theory, KBC for its Knowledge Forum environment, and Lampert's work for its detailed examination of teacher actions), there are several characteristics that they share in common. These include: (a) a diversity of expertise among its members, who are valued for their contributions and given support to develop, (b) a shared objective of continually advancing the collective knowledge and skills, (c) an emphasis on learning how to learn, and (d) mechanisms for sharing. It is these features that we take together as the essential elements of the CoL model.

The overall goal of a CoL classroom is to foster a culture of learning, where both individuals and the community as a whole are learning how to learn. Further, members of the community share their individual efforts toward a deeper understanding of the subject matter under study. This includes understanding how to pose disciplinary problems, explore problem spaces within a domain, and create and critique possible problem solutions. Students learn to synthesize multiple perspectives, solve problems in a variety of ways, and use each other's diverse knowledge and skills as resources to collaboratively advance their understanding. The intent is to develop deep disciplinary understanding of both subject matter and ways of working with knowledge, and for members to come to respect and value differences within the community.

BRINGING A COMMUNITY OF LEARNERS TO LIFE IN K–12 CLASSROOMS

The CoL model provides the specification of a desired goal state for K–12 classrooms. However, one of the key design challenges that teachers face is that the creation of CoL classrooms is not enacted on a blank slate. Bringing a CoL to life in K–12 classrooms involves fostering a very different culture from those found in industrial-era classrooms, and even most reform classrooms. We are interested in how to support the necessary shifts that teachers and their students must move through.

In order to support these change processes, teachers need a means for understanding how to cultivate a community of learners in their own classrooms. Describing CoL models in terms of activities or methods (e.g., reciprocal teaching) has led to problems, as developers point out that these elements of the model often become routinized to the point of "lethal mutations" (Brown, 1992). Such routinization is problematic because the

key theoretical underpinnings tend to be replaced with only a superficial understanding of their relevance. Further, the necessary flexibility to respond to the particular accomplishments and needs of participants is hindered. In order to keep visible the theoretical underpinnings and to promote flexibility, the models have tended to be specified in terms of design principles (Bielaczyc & Collins, 1999; Brown, 1994; Brown & Campione, 1996; Scardamalia, 2002).

The principles are themselves grounded in an epistemology and a theory of learning that need to be understood if the principles are to be enacted appropriately in classroom designs. The CoL model is founded on theoretical perspectives emphasizing learning as a process of enculturation, with a focus on *learning to be* rather than simply *learning about* (Sawyer, 2006; Thomas & Brown, 2007). Rogoff's work underscores how it can be quite challenging for adults who have grown up with models of learning based on transmission and acquisition of knowledge to come to understand a sociocultural perspective: "it is difficult for people unfamiliar with the concept to avoid assimilating it to the adult-run/children-run dichotomy" (Rogoff, 1994, p. 210).

The design principles, underlying epistemology, and perspectives on learning provide the theoretical grounding for the CoL approach. This grounding provides a strong foundation from which to work in that these elements help teachers to navigate the myriad implementation decisions and provide parameters that constrain the implementation design space. In turn, enacting the theory results in what we term "epistemological perturbations"[1] that disturb the regular functioning of the classroom. Given that school cultures tend to be "deeply rooted in the past" (Fullan, 2007, p. 35; see also Tharp & Gallimore, 1988, chapter 7), many of these perturbations are resolved in ways that return the classroom to familiar ways of functioning, rather than resulting in the necessary shifts (Cohen, 1988; Tyack & Cuban, 1995). Here we examine five aspects of classroom life where we feel change is crucial. We focus on these five points of change because we believe that they provide the most transformational leverage in bringing a CoL to life in the classroom:

- The curricular content (using student work as the driver)
- What students do (playing epistemic games as a collective)
- What teachers do (engaging in pedagogical moves at both the individual and collective level)
- The identity of students and teachers ("I am part of a community that is making progress on important problems")
- The contextual landscape (employing the social infrastructure as a mutually reinforcing system)

In addition to considering how these particular aspects of the classroom must change, we feel it is important to highlight a cross-cutting idea that provides support to such shifts. Implementing a CoL classroom involves bringing a specific classroom culture into being. If the community that students are being enculturated into is thought of as existing only in the classroom, then this culture must be created from scratch if implementation is to take place. This poses an enormous undertaking and raises issues of how to bootstrap a rich culture of inquiry. However, we feel that further transformational leverage is gained by instead viewing the CoL as engaging students in *peripheral participation* in authentic disciplinary communities (Lave & Wenger, 1991). The disciplinary

culture can thus guide the workings of the classroom, and students are socialized into working with knowledge in ways consistent with disciplinary norms and practices. Facilitating participation in existing communities that extend beyond the boundaries of the classroom provides a grounded and generative starting point. The perspective of enculturating students into disciplinary communities is a thread that runs throughout each of the shifts that we discuss below.

SHIFTING THE CURRICULAR CONTENT: USING STUDENT WORK AS THE DRIVER

It is common for teachers to create classroom activities that are meant to encourage students to think deeply about certain ideas. In CoL classrooms, the process works in reverse: students engage with their own ideas and those of others in the community in ways that determine the activities that get carried out. Even in Lampert's classroom where the teacher decides a specific mathematical problem to initially frame the community inquiry, the subsequent investigations and class discussions are driven by the students' own strategies, questions, and arguments. Scardamalia (2002) characterizes moving student ideas to the center with activities becoming subordinate as a dramatic change akin to the Copernican shift, and how "everything is understood differently and it becomes possible to move into new levels of work with ideas that could not even have been imagined before" (p. 76).

Putting students' ideas at the center of the community work communicates to students that their ideas matter to others and that they have a position of responsibility in contributing to the community's advancement. Further, centering on the students' own work is intended to support students in learning how to take control of the learning process. In this way, students not only learn about the subject matter, but also come to understand the means for working with and creating knowledge (e.g., finding problems, locating resources, testing ideas through experimentation, developing skills in argumentation, and the critique of various perspectives, etc.). Many teachers have observed an increase in student engagement when students' ideas drive the inquiry. For example, Richard Messina (2001) describes, "Rather than limit the students to passive 'clients' to a curriculum I had designed, I observed the incredible energy and interests of the students that sustained the knowledge building when they were encouraged to express their ideas and become more involved in the design of the curriculum" (p. 10).

Diversity in student work is valued. Brown and Campione (1996) point out that "diversity of interest and talents within the context of inquiry should enrich the knowledge base of the community as a whole" (p. 319). Not all student investigations need to resolve "successfully" for the community to advance its understanding. One strength of the community is participants' ability to compare among and learn from the diverse investigation paths. The key notion is that these different paths are not abstract entities, but rather the students' own paths. Students have opportunities to reflect on their personal efforts and the interrelationships their efforts have with the work of others in their community. The intent is that students come to "feel comfortable with the knowledge that their own ideas, no matter how satisfactory they may seem at present, are improvable" (Scardamalia & Bereiter, 2003, p. 6) and realize that they have the agency and are building the capacity for improving them.

Creating classrooms that are driven by student work can be challenging. Just because

students are provided with opportunities to generate questions and ideas that drive inquiry does not mean that they are at ease doing so. For example, the Whitman Team, a team of sixth- and seventh-grade teachers who worked to create a KBC classroom (Bielaczyc & Collins, 2006), described how transferring control of question generation to the learners can be challenging because (a) students who enter sixth grade have already been schooled to respond to questions, not to generate them, and (b) over time teachers have become used to asking the questions. For teachers, it can be difficult to prepare ahead of time, as each cohort of students can generate a completely different set of questions and investigations to pursue (Caswell & Bielaczyc, 2002). Further, Messina (2001) points out how teachers might not realize how they retain control, even when it feels like they have made significant changes in the classroom:

> Initially I felt comfortable thinking that knowledge building was occurring because students were not only reading but were doing experiments—"hands-on learning." I slowly realized that they were trying to solve my knowledge problems rather than their own. Experiments, on their own, do not guarantee that children are knowledge building. Authentic knowledge building takes place when students are making sense of information about a problem that is of interest to them. (Scardamalia & Bereiter, 1994, p. 279)

In order for student work to serve as a resource to the community, it is critical that this work be kept public. This is often accomplished through producing artifacts or performances that can be used by the community to further their understanding. In our work with teachers, it is very common to hear "I didn't know that my students could do that." We find that teachers' confidence (and students' confidence) in putting student ideas at the center tends to increase as they become more acquainted with all that is possible for students to accomplish. Teachers play an important role in bringing the community's attention to different aspects of the work, using the students' work as a resource for modeling, making connections to big disciplinary ideas, and other critical perspectives on learning. For example, the Whitman Team describes how:

> See, I think we're continually evaluating what's going on and setting models for performance, and showing kids examples from the database[2] of where somebody was thinking about something and as they were writing here, they said "oh, you know" and then came to some kind of a conclusion. So that they can, as they're doing it themselves or reading other people's notes, they can see ideas develop. And we do that a lot. I think we're continually pushing them forward. But not so that they can get a better grade. It's so that they can be a better learner.

An important issue raised in having student work as a driver involves concerns with curriculum coverage. Often there is a worry that if student work is driving the path of inquiry then the specific curricular objectives may not be met. One aspect that needs to be considered is *what is meant by "curriculum coverage"*? That is, coverage tends to be thought of as a linear sequence of topic-by-topic alignment to curriculum guidelines. However, a topic-by-topic approach may miss opportunities to develop a deep, interconnected understanding of the subject matter under study. In contrast, inquiry in a CoL involves engaging students with various facets of the discipline, approaching subject matter from multiple angles, and drawing connections across different aspects.

For example, Lampert (2001) describes how "Multiple situations are required for the mathematics to emerge; it is not in the situations but across them" (p. 255). She examines the fifth-grade mathematics curriculum through the lens of "conceptual fields." Such fields extend across topics and contexts in order to highlight key mathematical ideas. She points out that:

> The purposeful long-term work of making connections among the topics… remains largely invisible to many classroom observers. The work involved in raising mathematical structures to a level where they can be studied would be hard for someone to see if they were only looking for coverage in terms of getting through a linear series of topics one after the other.… In contrast to the familiar topic-by-topic approach, I worked on constructing lessons that were occasions for my students to investigate a number of different but related topics, and to investigate them repeatedly in different problem contexts. (pp. 259–260)

Lampert (2001) further elaborates upon the idea that what gets "covered" is not just about the mathematics subject matter. In addition, she works with the students from where they are and the issues that come up for them in thinking through how to cover the curriculum.

Clearly, even with breaking away from a topic-by-topic approach, if a curriculum favors breadth over depth, it can be difficult to achieve "coverage" with students pursuing investigations in depth. However, we share here Richard Messina's experience as a provocative consideration. Messina (2001) tells about the first time he taught using a KBC approach:

> When I presented to the class the fact that we were not covering the material other grade four students would have learned in a public school, the response I received was quite "illuminating." One child reported that they probably know more about light than any other grade four students because of how much time was spent in the study and the way they had built the knowledge by sharing it on the database. They also added that if they ever wanted to learn about sound, for example, they now knew how to conduct an inquiry: state a question, then offer a conjecture/personal theories, research through reading and experimentation, share your knowledge advances on Knowledge Forum and build the knowledge together. (p. 9)

In a fourth-grade class Messina had several years later, when the class specifically compared their work on light in the Knowledge Forum database with the expectations for understanding light in the Ministry of Education guidelines, the students determined that they had surpassed the expectations set for a grade 4 class.

SHIFTING WHAT STUDENTS DO: PLAYING EPISTEMIC GAMES AS A COLLECTIVE

One of the central aims of the CoL model is to help students become "socialized into the world of work with knowledge" (Bereiter, 2002, p. 220). The community engages with ideas as objects of inquiry that can be tinkered with, combined with other knowledge objects, and improved, similar to the corresponding disciplinary community of

practice. The intent is for students to develop a repertoire of disciplinary knowledge moves, and be able to engage in metadiscourse concerning the nature of these moves, along with the forms, goals, and rules of the knowledge work. To capture such goals, we use the framing of learning to play *"epistemic games"* (Collins & Ferguson, 1993; Morrison & Collins, 1995; Perkins, 1997).

Epistemic games are directed toward building knowledge and understanding (Perkins, 1997). Learning to play such games involves developing an understanding of the moves, constraints, and strategies for working with various types of *epistemic forms,* the representations used by disciplines to communicate knowledge work (e.g., classification trees, stage models). The overall goal is to support learners in developing *epistemic fluency*, "the ability to recognize and practice a culture's epistemic games, to understand their different forms of expression and evaluation, and to take the perspective of interlocutors who are operating within different epistemic forms" (Morrison & Collins, 1995, p. 44). Engaging students in the epistemic game play of a discipline is meant to provide insight into the workings of the disciplinary community. Lampert (2001) says: "Studying mathematics in this way involves my students in finding out what kind of activity mathematics is; it provides them an opportunity to learn and use the concepts, tools, and procedures that the field has developed" (p. 6).

As an example, one way that we might represent explanation-seeking inquiry within CoL classrooms is the "Progressive Investigation Game" (Figure 13.1). Students work together on a common problem (*Our Problem*) by proposing *Initial Ideas*. They also generate *Questions* that identify areas in need of further investigations in order to refine their initial ideas. The students then work to gather further information through *Investigative Work* or the *Exchange of Ideas*. This, in turn, leads to a refinement of the current ideas of the classroom community and further questions to pursue (*Improved Ideas and Questions*).

When students are first learning how to work collectively to play the Progressive Investigation Game it can be difficult to understand critical events and features, thus making it difficult to develop the necessary epistemological perspectives on community practices and an understanding of the moves, constraints, and strategies for working

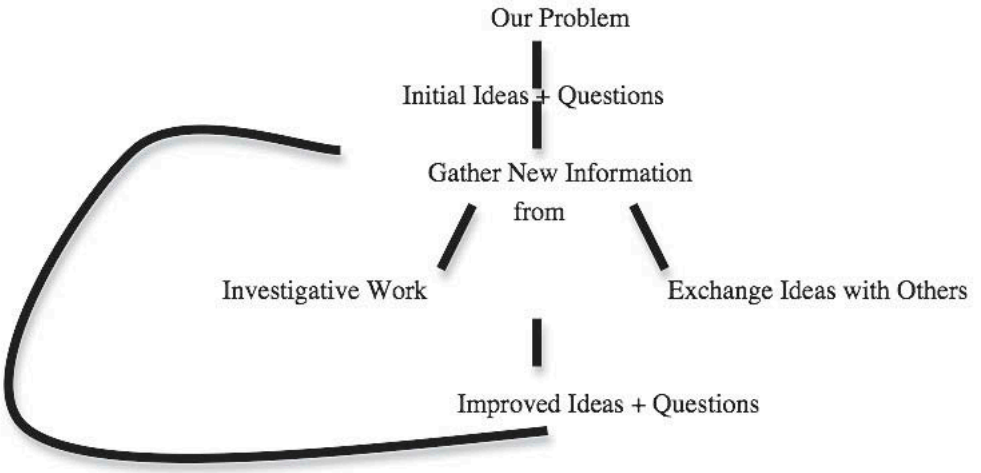
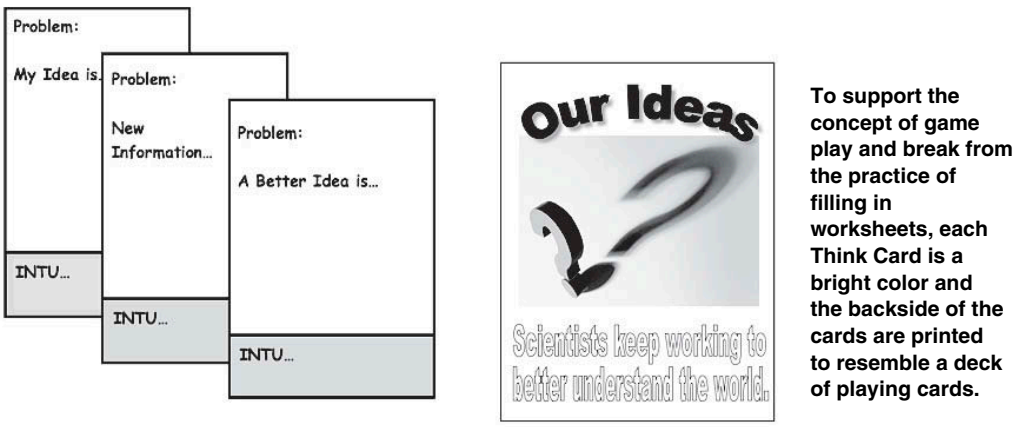


Figure 13.1 The basic flow of the Progressive Investigation Game.

with various forms of knowledge (i.e., epistemic fluency). In working with teachers to create KBC classrooms in grade 3 and 4 classrooms in Singapore, we have created specific tools that isolate parts of the full Progressive Investigation Game for practice and reflection (Bielaczyc & Kapur, 2010; Bielaczyc & Ow, 2010). For example, the Think Cards (Figure 13.2) are intended to physically reify students' knowledge building moves. They capture a sequence of explanations (*My Idea is …*), the new information that they bring to their inquiry (*New information …*), questions that drive their inquiry (*INTU* stands for "I need to understand"), and improvements that they make to their explanations (*A better idea is …*). The small, mobile nature of the Think Cards make it easy for children to work with their ideas—jotting down notes in the library or during discussions, spreading their cards out to examine the collection of ideas, literally "exchanging ideas" with others. We believe that it is important that a child can physically accompany the written form of his or her idea into a group discussion, thereby disrupting the conception that a written idea is a static response to a question when the child holding the Think Card is asked by peers to further elaborate the idea or the child defends the idea when it is challenged. The Think Cards also make visible the diversity of ideas that students generate for a particular problem of understanding and that can be collected from various resources, and the multiple pathways possible in moving from initial ideas to construct new knowledge. In this manner, students are scaffolded toward more complex knowledge building moves in Knowledge Forum.

One of the distinctions between the epistemic game play of the CoL classroom and that of most classrooms, including many reform classrooms, is that the play takes place in the form of *multiplayer games*. In other words, it is not the case that each player needs to make the full range of moves in a given game by him- or herself, but rather it is in interaction with each other's contributions[3] that the knowledge advances are made. In the Progressive Investigation Game this is accomplished by ensuring that the ideas, questions, and results of investigative work and exchanges are made available to all members of the community. In this way, one student can propose an initial idea, a different student may independently carry out investigative work related to this idea, and yet another student may contribute an insight that comes from synthesizing the



(front view) (back view)

To support the concept of game play and break from the practice of filling in worksheets, each Think Card is a bright color and the backside of the cards are printed to resemble a deck of playing cards.

Figure 13.2 Ideas First Think cards.

investigative work with the contributions made by others. Playing epistemic games as a collective permits a community to advance further than might be possible by individual epistemic game play alone. The classroom community thus mirrors disciplinary communities where individual members make contributions, others act upon such contributions (improve upon, synthesize, argue against, etc.), and knowledge is created and refuted through the collective workings of the whole. Scardamalia and Bereiter (1994) comment on this approach: "More significant implications follow when the question is reformulated at the level of the group rather than the individual. Can a classroom function as a knowledge building community similar to the knowledge building communities that make up the learned disciplines?" (p. 270). In CoL classrooms, students engage in epistemic game play in ways that contribute to the collective, distributed construction of knowledge.

An important issue raised in playing epistemic games as a collective is that engaging students in shared, public efforts involving argumentation and explanation construction can lead to social discomfort. Lampert and her colleagues (1996) documented how students in her classroom found the emphasis on argumentation at odds with their desire to get along with other students and not to criticize them. They described the "difficulties that arise from mixing social interaction with the refinement of ideas" (p. 757), such as the feeling of "personal assault" (p. 744) or worries of being ostracized by others in the community.[4] Cultivating a CoL in the classroom involves working over time to develop a culture of trust. Scardamalia (2002) points out that: "For such work to prosper, the culture must be one of psychological safety, so that people feel safe in taking risks—revealing ignorance, voicing half-baked notions, giving and receiving criticism" (p. 78). There is a need for sensitivity to student comfort levels and the ways in which students' previous experiences have prepared them.

SHIFTING WHAT TEACHERS DO: ENGAGING IN PEDAGOGICAL MOVES AT BOTH THE INDIVIDUAL AND COLLECTIVE LEVEL

Describing teachers as "facilitators" or "a guide on the side," while accurate, does not address the necessary level of detail for helping teachers to shift the ways in which they support students in their learning. What are the necessary types of *pedagogical moves*? In CoL classrooms, teachers need to become adept at anticipating and responding to student needs (both in the moment and across longer time intervals), finding ways to scaffold student participation, and reflecting back students' actions to the community in ways that foster shared understanding and discourse. The pedagogical moves serve as a means of transferring control of the learning process to students so that they themselves come to understand and enact the moves needed to participate in a CoL. Thus, the types of pedagogical moves that teachers engage in shift over time as students begin to develop agency and take responsibility for the community inquiry.

An example of the types of pedagogical moves that can be used to foster productive discourse to advance the community's inquiry comes from classrooms studied by Sarah Michaels and her colleagues (Michaels, O'Connor, & Resnick, 2008; Michaels, Shouse, & Schweingruber, 2008). Their work focuses on "accountable talk," where classroom talk is held accountable to three elements: (a) to the community so that everyone is supported to learn and contribute, (b) to logical reasoning so that arguments are supported with evidence, and (c) to knowledge so that students base their arguments on

established facts and concepts. In regard to the community, they suggest a number of conversational moves that teachers can use to open or extend a discussion, such as: "Who can put into their own words what Keisha just said?" or "Does anyone else want to add on?" (Michaels, O'Connor, & Resnick, 2008, p. 286). They find that "teachers who have implemented these discourse strategies have shifted away from simple questions and one-word answers and opened up the conversation to problems that support multiple positions or solution paths" (p. 287).

Pedagogical moves go beyond discourse moves. They may involve highlighting the actions or information from a particular group to the entire class, bringing in specific resources for student investigations, and modeling of various inquiry strategies. For example, Lampert writes multiple conjectures on the board to make visible students' ideas in order to foster both agreement or disagreement, and elaboration or modification (Lampert, 2001).

One key aspect of pedagogical moves in CoL classrooms is that they are directed toward responsiveness and guidance at both the individual and collective levels. Because the goal is to cultivate a community that mirrors the types of knowledge work carried out by disciplinary communities in the world, there is a need for attention to the progression of the community itself, and thus for pedagogical moves that address the community as a whole. Understanding how well the collective is progressing is aided by keeping student work public and coming at the developing understanding from multiple perspectives. Pedagogical moves that provide opportunities to interact with persons, ideas, and problems from outside of the classroom community may help the collective to realize: "What do we know?"; "What are we capable of?"; and "Where do we need to improve and grow?"

An important issue raised in engaging in the needed types of pedagogical moves is that doing so may lead to social discomfort for teachers. The nature of this discomfort tends to revolve around issues of authority and respect (e.g., feeling comfortable enough to say "I don't know" to students), as well as worries in seeing students struggle in their learning (e.g., allowing students to explore and fail to find solutions without intervening with "the answer"). The power of working as a collective to advance understanding is that the classroom community often goes deeply into disciplinary content and engages more fully with the complexities of the learning process. This can be both exciting and challenging for teachers. Similar to the discussion earlier about building a culture of trust for students, it is critical that the school environments in which the teachers work support them in learning and taking risks (Darling-Hammond & Sykes, 1999; Evans, 1996; Fullan, 2007).

SHIFTING THE IDENTITY OF STUDENTS AND TEACHERS: "I AM PART OF A COMMUNITY THAT IS MAKING PROGRESS ON IMPORTANT PROBLEMS"

In shifting toward CoL classrooms, we pointed out that social discomfort may arise for both students and teachers. This discomfort stems in part from changes to one's *identity* in the classroom; that is, how one views oneself and how one is perceived by the community. Who one is expected to be in a CoL classroom may be quite different from who one is expected to be in one's existing educational context, resulting in uncertainty and discomfort as one moves away from familiar roles.

Who are students and teachers meant to be in a CoL classroom? We feel that the positioning of students and teachers is nicely captured in the phrase: "I am part of a community that is making progress on important problems."[5] This statement captures both an *individual* identity of contributing in a variety ways to helping to advance the work of the collective and a *community* identity of a group that is working together on important problems. Members of the community take on different roles and develop individual areas of expertise and talents. In turn, by working toward common goals and developing a collective awareness of the expertise available among the members of the community, a sense of "who we are" is fostered.

The development of student identity within a CoL involves students assuming positions of responsibility, where they serve as resources for each other and they have a say in the overall workings of the community. For example, Brown (1994) describes how students in FCL classrooms take on multiple roles—for example, "students as researchers and teachers" (p. 8) and "everyone in the community is at some stage an actor and an audience" (p. 10)—and the community itself functions as a community of researchers. Further, both the FCL and KBC models position students as codesigners of the intervention itself with a role in improving the principles (Brown 1992; Scardamalia & Bereiter, 2006). The variety of roles provides ways for students to participate in shaping both their own paths and the ways in which their community functions.

Teachers are meant to see themselves not as lone change agents, but rather as joining others as part of a larger effort to understand how to cultivate CoLs in K–12 classrooms. It is important that teachers view their role not as an implementer of a *given* approach, but rather as a participant in a community inquiring into ways of bringing a CoL to life in a classroom. Because a CoL involves a way of being, if teachers participate in a CoL among professional colleagues, then not only does it allow them to engage with a supportive community working together to advance understanding of the model, it also deepens their understanding of "what it means to be part of a CoL." As an example, teachers working to create a KBC classroom can participate in the existing international community among teachers, researchers, and other educational stakeholders who are working to implement the model in their local contexts.[6] The international community itself employs Knowledge Forum as a means of supporting knowledge creation among participants. Participants also meet face-to-face at professional conferences, in visits to each other's schools, and at the yearly Knowledge Building Communities Summer Institute.

The intention of the CoL approach is to legitimize and value differences among participants. Brown (1994) describes the richness of such an approach as follows:

> It is very much our intention to increase diversity in these classrooms…. In our program, although we assuredly aim at conformity on the basics (everyone must read, write, think, reason, etc.), we also aim at nonconformity in the distribution of expertise and interests so everyone can benefit from the subsequent richness of knowledge. The essence of teamwork is pooling expertise. Teams composed of members with homogenous ideas and skills are denied access to such richness. (p. 10)

Valuing diversity provides space for exploring and developing one's own varieties of talents, rather than calling for conformity to a fixed norm. An individual can be working on something that no one else in the community is working on, yet the work

can be of interest to others in contributing to the collective goals. In addition, the community may come to depend on the expertise developed by various individuals. Thus, students and teachers can feel empowered at being part of a collective enterprise that works together toward shared goals, impacting motivation and engagement.

An important issue raised in developing identity within a CoL classroom concerns the time that may be required to shift the culture of the classroom. The shift depends on the current state of the classroom and the nature of the immersion into a CoL approach. That is, if the participants are already acculturated quite differently from a CoL, then making a shift in individual and collective identities may take several months or years.

SHIFTING THE CONTEXTUAL LANDSCAPE: EMPLOYING THE SOCIAL INFRASTRUCTURE AS A MUTUALLY REINFORCING SYSTEM

Creating a CoL classroom also involves attending to the contextual landscape of the entire classroom environment. The contextual landscape involves a broad spectrum of social structures, including the classroom norms and practices, the means for participating in shared activities, and ways of accessing various technical elements. It is critical that the various social structures of the classroom are seen as forming a systemic whole, rather than being experienced as separate parts. That is, there is a need to not only understand the importance of individual elements, but to also attend to the interconnections among the elements and the emergent properties of these interactions. Brown and Campione (1996) wrote about this point in a colorful manner in describing the importance of viewing the design of FCL as an integrated system, rather than a set of individual components that could be chosen like items from a Chinese menu. They emphasize the power of a system of elements that mutually influences and reinforces each other:

> There are by now many procedures available that were designed to foster thinking. These procedures are part of the teacher's toolbox. But the procedures are understood as unrelated tools, not as systems of interdependent activities.… Teachers may, for example, decide to include forms of cooperative learning, the use of long-term projects, a writer's workbench approach, etc. The problem we see is that such an approach ignores the potential power of creating a classroom system of activities that mutually influence and reinforce each other.… There is a purpose for every activity, and nothing exists without a purpose. All members of the community—students, teachers, parents, and researchers alike— should be aware of this. (p. 314)

Based on the perspective of a mutually reinforcing system, Bielaczyc developed the Social Infrastructure Framework in order to make explicit the various elements of classroom social structures impacting the design of classroom learning environments (Bielaczyc, 2006). The Social Infrastructure Framework highlights four dimensions of classroom social structures:

- The *Cultural Beliefs Dimension* refers to the mind-set that shapes the way of life of the classroom. The design considerations include the ways in which knowledge

and learning are conceptualized, students' and teachers' social identities, and how technology-based tools are perceived.

- The *Practices Dimension* concerns the ways in which teachers and students engage in both online and offline learning activities relating to the technology-based tool. This includes issues such as whether students work individually, in groups, or both; and how such groupings are organized. It also includes the various roles a teacher assumes in using a technology-based tool with his or her students
- The *Socio-Techno-Spatial Relations Dimension* refers to the organization of physical space and cyberspace as they relate to the teacher and student interactions with technology-based tools.
- The *Interaction with the "Outside World" Dimension* refers to the ways in which students interact, online and offline, with people outside of their immediate classroom context.

Although listed separately, these dimensions of social infrastructure are interdependent, with the cultural beliefs posited as a substrate for the interactions (Figure 13.3).

In our current work with teachers, we have been using the Social Infrastructure Framework as an explicit tool for designing and analyzing teacher implementations of CoL classrooms. We find that it not only serves as a useful shared language among teachers, but that it also helps to create awareness of the interconnectedness of classroom social structures. The idea is to move beyond consideration of individual classroom components to look for systemic relationships among the various social and technical support structures.

In creating a system of mutually reinforcing social structures, one consideration involves the "embodied epistemology" found in the practices, tools and classroom arrangements of learning environments. For example, there is a story about John Dewey buying desks for his Chicago school. A sales clerk showed him desks typical of the time—wooden desks with seats attached directly to the desk and legs that bolted to the floor. Dewey was reputed to have said that the desks were inappropriate because they were built for listening not learning. Because the desks would be fixed in position, they would have a bias against more participatory ways of learning. The idea is that elements of a classroom-learning environment, whether they are physical artifacts or cultural practices, embody a particular epistemology that biases different ways of knowing (Ow & Bielaczyc, 2008; Scardamalia & Bereiter, 2008). Thus, changing the contextual

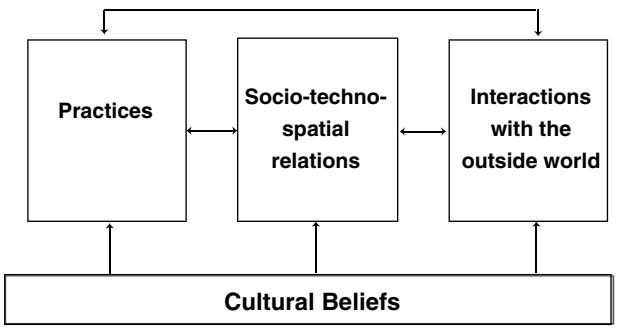


Figure 13.3 The social infrastructure framework as a system of interactions.

landscape so that the biases across the social infrastructure of the classroom mutually reinforce the epistemologies of the CoL approach constitute an important means of supporting the shift to the new model.

CONCLUSION

In considering how to cultivate a CoL in K–12 classrooms, we have discussed both key theoretical underpinnings along with five key changes in classroom life that we believe provide the most transformational leverage in bringing a CoL to life. These key changes comprise: (a) the curricular content (using student work as the driver); (b) what students do (playing epistemic games as a collective); (c) what teachers do (engaging in pedagogical moves at both the individual and collective level); (d) the identity of students and teachers (becoming part of a community that is making progress on important problems), and (e) the contextual landscape (employing the social infrastructure as a mutually reinforcing system). In discussing these areas, we have emphasized that each involves both an individual and collective aspect (reflecting both participant- and community-level considerations), along with the associated challenges and implementation considerations.

Although the CoL model may require a "radical reconceptualization in practice" (Bielaczyc & Collins, 1999), we believe that there are many benefits to making such a change. The model is intended to foster deep disciplinary understanding of both subject matter and the ways in which the disciplinary community works with knowledge in a domain. In this way, the model supports moving beyond "learning about" content knowledge to "learning to be" active in community practices and to develop a more robust epistemology. Students develop the agency and tools for engaging in complex disciplinary investigations. They also begin to understand the value of multiple perspectives, reflection, and the time and processes involved in knowledge work. In addition, student motivation and engagement may be impacted, as students' talents and the work that they are doing matters to others in the community.

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NOTES

1. Elsewhere we have described how we use the purposeful creation of "epistemological perturbations" as a design strategy in design research (Bielaczyc & Ow, 2007; Ow & Bielaczyc, 2007, 2008).
2. The teacher is referring to the Knowledge Forum database, which allows the contributions of each student to be visible to all members of the classroom community.
3. Note that we did not speak of "interactions among the players themselves," but instead of "interactions among the players' contributions." In CoL classrooms, just as in disciplinary communities, the players need not specifically engage each other for their contributions to indeed interact and lead to advances in the community's knowledge. Of course, as in disciplinary communities, actual interactions and collaborations among players can also play a valuable role within the community.

4. Interestingly, their work underscored that such difficulties occur not only with children in CoL classrooms, but also with adults in the professions and other scholarly communities that involve critiquing ideas as well.
5. This quote is drawn from Bereiter's (2002) descriptions of participation in knowledge creating communities.
6. Refer to http://ikit.org

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