CSCL as a Catalyst for Changing Teacher Practice

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Abstract: This paper presents results of a study of middle school teachers using a prototype Macintosh version of CSILE to help create a knowledge-building community. The study, involving middle schools in two school districts in the Southwest United States, provided teachers with training and technical support in the use of the CSILE over a period of one semester.

In-depth interviews were conducted with the teacher participants a year after the termination of the project to understand their experiences and to learn their stories of the impact of the Knowledge-Building Community Project on their teaching practices. Five major themes emerged from the analysis of the interview transcription data. This paper presents a summary of the teacher reflections and stories related to the emergent theme of how the knowledge-building community changed their teaching practices, roles, the structure of their classroom discourse, and their views of curriculum. The results of the study suggest that CSILE, accompanied by appropriate support, can serve as a catalyst in changing teacher practices from didactic teaching to more constructivist approaches to learning. The paper presents teacher reflections on changes in their roles, views of curriculum and classroom discourse as a result of the knowledge-building community project.

Keywords: shared knowledge, constructivism, curriculum

Introduction

The goal of the study was to understand the experience of middle school teachers related to the long term impact of a knowledge-building community project on their teaching practices. The concept of knowledge-building community guiding the project was based on the work of Scardamalia and Bereiter. They describe knowledge building communities as schools in which people are engaged in producing knowledge objects that lend themselves to be discussed and tested and in which students see their main job as producing and improving such objects (Scardamalia and Bereiter, 1994). Such a vision represents a significant departure from the traditional views of the schooling process and roles of teachers and students but is congruent with other emerging ideas for restructuring schools, such as Brown and Campione's (1990) proposal that schools serve as communities of learners and thinkers. It also represents a departure from typical efforts to institute change in schools.

As noted by Sarason (1996), most attempts at reforming education are fundamentally flawed, as they do not attempt to change the structure of discourse within the classroom setting. The typical structure of discourse in classrooms may be portrayed as the teacher standing in the center of the dialogue, such that s/he acts as the conduit for nearly all of the verbal exchanges that take place. Doyle (1986) notes that most oral discourse that takes place in classrooms may be characterized as recitation. Heap (1985) indicates that classroom dialogue typically is comprised of three step units consisting of the following dialogic interactions: teacher initiates, student responds, teacher evaluates. These practices stem from common sense notions about schools and what Tyack and Tobin (1993) term the "grammar of schools."

Because knowledge-building communities demand such dramatic shifts in mind-set and teacher practices, they stand contrary to the common sense notions about schools– what Tyack and Tobin (1993) call the "grammar of schools." Consequently, as noted by Kolander and Guzdial (1996), it was recognized that the views of "traditional schooling" would represent a significant challenge to the adoption of a technology supported knowledge-building community. A joint university/public school partnership was formed to plan and implement the knowledge-building community in the four participating middle schools. The goal of the Knowledge-Building Community projects was to develop a knowledge-building community in the classroom and to determine the perceived impact of the collaborative technologies and support on teacher practices and the structure of discourse in the classroom.

Description of Knowledge-Building Community Project

The Knowledge-Building Community project provided for the infusion of an Apple version of CSILE called MacCSILE (later called Co-Learning) from one of the initial pilot districts (five teachers at two middle schools in a suburban district) to another public school district (four teachers at two middle schools in an adjacent urban school district. MacCSILE is based on established cognitive learning strategies (Scardamalia, et al., 1987). Translating the cognitive science guidelines into features of CSILE software has resulted in different implementations since CSILE was first introduced in an urban elementary school in Toronto, Ontario in 1987, but several core features have endured.

The heart of the system is a student-generated database that begins empty, but grows as students enter their text or graphical notes. Students are encouraged to address all aspects of their learning process in these notes–their wonderments, their questions, their theories, their knowledge goals and gaps, their plans for pursuing their knowledge goals, their new learning–by having the choice of stamping each entry with a "thinking type" that describes the nature of a given entry. The use of the thinking types helps students make their covert knowledge construction activities more overt, as well as encouraging specific cognitive learning strategies such as questioning, identifying knowledge lacks, and making plans for pursuing specific knowledge goals.

Two middle schools from a high SES suburban school district, "Lakeside ISD" and two middle schools from a large urban school district, "Central ISD," were included in the

study. The nine teachers participating in the study represented a cross-section of middle school subjects, grade levels, teaching experience, and teaching styles. The CSILE experienced middle-school teachers provided inservice training, direct mentoring, reflective modeling, and on-line support to the teachers from the other school district. One two-day inservice session hosted at the university and led by the experienced teachers marked the official project opening and was attended by the teachers and the university faculty. From that point participants met one day monthly at alternate school sites to discuss progress, concerns, challenges, and specific technology or design issues they were addressing.

The one-semester implementation of the project was built on the substantial training and experience base of the four local district teachers who had been involved in the Apple/OISE (Ontario Institute for Studies in Education) beta-test piloting of the MacCSILE software. The project provided a unique opportunity for these teachers to test and extend their knowledge building as they served as peer mentors for other educators in exploring applications of the MacCSILE software to their particular settings.

While the experienced teachers served in schools with demographics of predominately-Anglo middle and upper-middle SES suburban children, the newly-identified urban sites–by design–were markedly different: one lower SES junior high and one lower to lower-middle SES middle school with demographics of high proportions of bilingual, free or reduced lunch, and at-risk students. The urban schools also had a history of higher percentages of truancy and drop-outs. The suburban school district had a district-mandated policy of computer competency requirements for all teachers and a district-wide advocacy of computers and technology-supported learning which was eagerly supported by their relatively technology-literate, affluent parents and patrons.

Modeled after the original Apple/OISE plan for computer placement used in earlier pilots, the technology configuration of the project called for four or five computers in each classroom of the teachers from each of two newly-included schools and two extra computers for one of the experienced/mentor sites. The classroom computer sets were networked to a dedicated server in one of the teachers' classrooms at each site. Each teacher at each site worked both independently and collaboratively to consider and design specific units of study or supportive curriculum opportunities for their classes to explore the use of the centerpiece networked software, the MacCSILE program.

Once monthly the teachers were given a full day of release time to meet with the other participants and support staff. The group met alternately at one of the campuses to discuss progress, frustrations, difficulties, and technology issues, and to report on the status of their classes in coming to use the software and demonstrate collaborative knowledge-building, as well as to reflect on the teachers' processes and challenges. By the time the semester closed the project group had met six full days and had developed a level of connectedness and collegial interchange, which had made notable impressions on each member of the team.

In the end each of the newly-initiated teachers made significant declarations regarding their professional lives, their considerations of their teaching role, their understandings of students as active learners, their perceptions of the relevance of computers to the evolution of a collaborative knowledge-building community. For some it was a rekindling of what they had long believed about teaching and learning; for others, it provided a revealing look at alternative views. In the final analysis, the individual, personal, professional and the institutional impacts of the project on the participants far outstripped the limited exposure and implementation time. Lingering questions remained about the resiliency of the changes, the implications of the teachers' experiences for ongoing professional development, the teachers' embrace of alternative social-constructivist pedagogy, and teacher interest and integration of technology in the classroom. These are the questions that led to the effort to revisit the participating classroom teachers a year later and to collect their stories and their reflections in in-depth interviews.

Method

A follow-up study, was conducted with the nine teacher practitioners who participated in the semester-long Knowledge-Building Project. An in-depth, open-ended interview format was selected as the research format to put the teachers at ease and to set an exploratory and conversational tone to the interview process. Eleven questions were asked in a specific order and the researchers explored any relevant aspect that emerged from the teacher answers. The specific focus and sequence of the questions focused on a number of interrelated aspects including the technology, teacher persona, pedagogical issues, curriculum, school and district level policies, resources and support, school/district climate for change, and teacher culture.

Each interview took from one to two hours and focused on each teacher's perceptions about the opportunities, challenges, barriers, and the changes and the new developments–temporary or long term–that were a result of the project activities and technology tools. The taped interviews were transcribed and a comprehensive report was prepared and submitted to the funding agency (Christal, Ferending Lenert, Kennedy Puthoff, and Resta, 1997).

Summary of Findings

The analysis of the teacher interview transcripts yielded five emergent themes, including how: 1) the knowledge-building community changed teacher practice; 2) adoption of CSILE transforms social interaction in the classroom; 3) support acts as the structural framework for the diffusion process; 4) "resistance" and structural factors act as barriers to the development of a knowledge-building community; and, 5) teachers' models of educational technology prescribe a new professionalism. A comprehensive description of all the above themes is described by Christal et al (1997). This paper focuses more narrowly on the emergent theme of how the knowledge-building community changed teacher practices. The names used in the summary below are not the real names of the teachers.

Changes in Classroom Discourse

One of the important changes reported by participating teachers was the change in the structure of classroom discourse. Sarason (1996) asserts that the observable criterion which signals a change in the structure of classroom discourse is "question asking in the classroom" (p. 361): who asks the questions, what are the nature of the questions, how and by whom are they answered? Sarason explains that the legions of youth who display a great deal of curiosity, questioning and creativity outside of school to understand their world, their culture and themselves in arenas that are often unsanctioned in the schools, are too often turned off by social studies, science, and literature as taught in schools. Why this is so? Sarason speculates as follows:

> … In our well-intentioned but misguided efforts to pour information into the minds of children we are rendered insensitive to what *their* interests, concerns, and questions are… We do not *respect* what is in their heads, i.e., they are not thinkers, they have unformed minds which it is our jobs to form. … In *practice* we regard children as incapable of self-regulation. (Sarason, 1996, p. 363, author's italics)

Sarason's argument reflects several findings of this study regarding knowledge-building communities. First of all, we have seen how several teachers characterized their teaching practice prior to CSILE as traditional, featuring the teacher's control of classroom discourse. For instance, Charles' classroom practice was characterized by highly structured Socratic questioning. After using CSILE he had reduced the "teacher-directed" component of his practice down to 30% of his total classroom activity. Several teachers, particularly attested that giving students more choice, extending trust to students, and handing students more control over their own learning were key factors in transforming teacher classroom practice. Another teacher recognized the secret to selecting appropriate problems for CSILE classroom investigations was to support her students' deep concern for the natural environment and allowing them to come up with their own solutions for improving it.

CSILE researchers have noted that CSILE has subtle effects on classroom discourse by enabling certain kinds of information flow that are at least conducive to educational change. It opens up a channel of communication in the classroom that is not teacher-mediated and, since not all students can work on CSILE at the same time mitigates against the traditional teaching-learning model in which all students are doing the same thing at the same time. (Scardamalia, Bereiter, & Lamon, 1994, pp. 208-209).

In addition to these subtle effects, CSILE introduces what we have called a "philosophical framework" with an emphasis on collaborative learning that engages students and their teacher(s) in a shared discourse and the construction of a common knowledge base. This approach is very different from the transmission-based classroom structure.

Student-Directed Learning

Perhaps the most obvious change noted by our informants was the change from teacher-directed classroom practices to student-directed learning. The change was expressed as one of degree rather than of absolute change. In fact, several teachers noted that there will always be a place for direct-teach methods such as lecture, recitation, and independent seatwork, because these are such efficient methods of exposing students to basic information. Some of the teachers reported having made dramatic changes in their teacher-directed/student-directed ratio. While other teachers did not speak of perceived changes in their instructional practice specifically in terms of "student-directed," they were clearly making a transition towards adopting increasingly student-centered approaches based on their statements about class organization, curriculum development and instructional procedures.

Collaborative Learning

Another change in teaching practice that the knowledge-building community requires is a change from independent student learning to collaborative learning. As a form of computer-supported collaborative learning software, CSILE provides a workspace for knowledge construction that is very public. It encourages collaboration by acknowledging and embracing all steps of the knowledge construction process, including questioning, guessing, predicting, planning, theorizing, and discovery, and making that otherwise private effort at learning public. The learner's peers are then encouraged by the software design to collaborate and facilitate each other's learning through commenting, linking, and group-authored notes. The participating teachers were impressed by how CSILE promoted collaboration among their students. For example, Nancy, who had been highly traditional in her teaching style for her whole career, focusing on individual learning, became a proponent of collaboration after her experience with CSILE, so that the sharing of learning became a vital element to her new understanding of classroom practice. She noted that:

> "What is important to me is that a student has the freedom to be an individual learner and that he/she can learn something and then want to share it with others and own something that is totally his. He sees it through his own eyes and it becomes part of his fabric and then by sharing it with others hopefully they can be enlightened and see the learning through his eyes."

Collaborative learning is so fundamental to the application of CSILE that, as Peggy explained, "Teachers who aren't used to having students work together, it [CSILE] is going to force them to."

Multiple, Simultaneous Learning Activities

One way CSILE subtly engenders changes in instructional practice is that while a portion of the students occupy themselves on the four or five workstations interacting with the networked knowledge base, the remaining students must occupy themselves in non-

computer activities. The typical classroom situation where all students learn the same content in "lock-step" fashion, with the teacher lecturing to an entire class or where all students are working independently on the same seatwork, will not work in a CSILE-based classroom structure. The teacher must utilize other instructional strategies that allow students to work on different learning activities simultaneously during the classroom period.

The requirement for multiple, simultaneous learning activities moved the teachers into the role of learning guide and facilitator of collaborative learning. Since all students could not work on the same activity (e.g., because of a 5:1 student/computer ratio), then giving them a choice of knowledge-constructing activities became a viable alternative. This involved the teachers "letting go" and trusting the student to pursue their knowledge goals more independently. Several of the project teachers described how their practice had changed to support a class where students were doing many different things at once. Charles, for instance, remarked how he "saw that if we had the curriculum designed properly, and the kids had multiple jobs to do, that would free us up to facilitate." He described one typical day when his classroom was working well:

> "We had some kids who were trying to finish up the River Project at that time, they were working on that. I had another group who were on the computers, kids who had gone down to the lab on their own, and I had kids who were in the library or Jack's room working on the books trying to work on a due date for the chapter. So, I guess that happened often. That was a pretty magical example of how all these things were going on at one time. And I think that for me, when that would happen, and it would happen at least half or two-thirds of the week, that was an evolution for me."

Fundamental Changes in Curriculum Development

Traditionally, instructional practice, as the defining factor of a teacher's professional duty, requires that the teacher *locally implement* a curriculum, which has been determined *outside* the classroom. Curriculum is the *what* to teach. Instruction is the *how* to teach. The tacit assumption behind this division between curriculum and instruction is that knowledge can be specified in a decontextualized manner, and that prespecified knowledge will result from engaging in proper learning activities. In a knowledge-building community, knowledge is constructed in the context of pursuing higher learning goals. Teachers, often in collaboration with their students, design the higher level learning goals and a learning environment that supports the pursuit of those goals. The assumption now is that much of what has been the traditional curriculum may be encountered along the way, but those traditional learning outcomes are no longer prespecified in the traditional, externally specified and decontextualized sense of curriculum. Students encounter traditional facts on a need-to-know basis, where the need is determined by the requirements of the learning goal and not because the facts are in the curriculum and will be on the test.

The difference between traditional curriculum and instruction and knowledge-building communities may seem subtle at first. They both have in common the goal of student learning that can be assessed in traditional tests, and CSILE research indicates that students in a knowledge-building community will perform as well as or better than students in traditional classrooms on standardized tests (Scardamalia, et al., 1992; Scardamalia, Bereiter, & Lamon, 1994). Yet, the knowledge-building community is not merely a *platform* for the delivery of curriculum. It is a fundamentally different approach to learning that breaks down the artificial separation between curriculum and instruction. Curriculum and instruction become subsumed in the practice of creating a knowledge-building community. Knowledge-building communities therefore change the teacher's relationship to curriculum in several fundamental ways.

We have seen at least four ways the notion of curriculum has changed for the participants of the Knowledge-Building Communities project. First, curriculum becomes for the teacher less a plan for achieving predetermined outcomes and more of an environment designed to enable knowledge-creation in a specified arena of discourse. Second, curriculum has less of a focus on subject matter or content and more of an environment designed around themes, projects, or problem solving. Third, use of curriculum designed by outside specialists diminishes, as curriculum designed through collaborative brainstorming between members of the learning community, including teachers and students, becomes commonplace. Finally, we have seen that, rather than falling into a fixed set of desired learning outcomes that requires considerable effort to change (usually by outside experts), teachers are continually revising their curriculum design based on their on-going experience and emergent instructional needs. Each of these shifts is examined in the following sections.

A Shift in Curriculum: From a Plan to a Learning Environment

A traditional view of curriculum depicts it as a plan for achieving predetermined learning outcomes. In a given course, students participate in learning activities that are guided by learning goals mandated for that course, usually in a specific sequence. By accomplishing the learning tasks for a few learning objectives every day, they build up sufficient knowledge and skills to satisfy the learning goals set by the curriculum. In contrast, within a knowledge-building community the notion of curriculum shifts from a *plan* for achieving predetermined learning outcomes to that of a learning *environment* designed to enable knowledge-creation in a general area of interest. Learning outcomes are still a teacher concern, as revealed by teachers' statements about the kind of state-mandated curriculum coverage they were able to achieve. The difference, however, is that coverage of the curriculum occurs in a non-linear fashion. Teachers design a learning environment which contains all the elements of their curriculum, but also gives students as much responsibility as possible to engage in their knowledge-building activities whereby they encounter the more traditional curriculum learning objectives on a need-to-know basis. As Jack put it, "students do what they feel like they *need* to do rather than what they *have* to do."

The traditional approach to curriculum builds up knowledge primarily by accretion. It is an efficient and thorough way of covering the lower level forms of knowledge such as

comprehension and application, but tends to sacrifice higher level uses of newly acquired knowledge in analysis, synthesis, and evaluation. In a knowledge-building community, knowledge goals start out being high level goals, and it is something of a leap of faith, later born out by teacher experiences, that students will encounter the traditional learning objectives as they pursue these higher learning goals. As mentioned earlier, CSILE research does support the claim that students are learning at least as much as students in traditional classes, based on standardized achievement test scores (Scardamalia, et al., 1992; Scardamalia, Bereiter, & Lamon, 1994).

Curriculum Designed around Themes, Projects, or Problem-Solving

Traditionally, curriculum is subject- or content-based. The accepted domains of knowledge that define the structure of curriculum have endured for centuries, such that the sciences, social studies, mathematics, and language arts are all conceived in the curriculum as separate entities with their own unique forms of knowledge and content. The knowledge-building community approaches we have seen in our project, however, have tended to cut through these curricular partitions and focus instead on themes, projects, or problem-solving activities that may draw on an interdisciplinary base of knowledge construction. Though none of these approaches require interdisciplinary study, they do open up that possibility, and we have seen several of the project teachers capitalize on the interdisciplinary opportunities afforded by CSILE.

A prime example of the way a project-based curriculum can support interdisciplinary collaboration is the historical novel project at one middle school that involved all of the Knowledge-Building Communities teachers at that site. The project, which extended across two semesters, addressed an entire year of American History curriculum as well as an entire year of Honors English and regular Language Arts, which also addressed literature and writing. The teachers demonstrated that not only could a long-term project support a sustained interdisciplinary study, but also, in their two-week "lesser man" thematic unit, feature an intense synthesis of a wide range of historical issues, current events, and literary works. This was a short-term project originated opportunistically from an enthusiastic classroom discussion conducted by Charles and his student teacher about *Huckleberry Finn*, and was implemented in the CSILE database. In this project students integrated concepts about social power and status from a wide range of sources they were exploring in their history, language arts, and honors English classes.

Curriculum designed Through Collaboration between Members of the Learning Community

Traditionally, the source of curriculum is from outside specialists who attempt to design a curriculum that will fit educational requirements specified by authorities at state and federal levels. Such efforts are quite capable of addressing the top-level concerns for education, but are not likely to address the local conditions of a given knowledge-building community. The approach to curriculum reported by the teachers exemplified collaboration between all members of the community in the creation of curriculum. Not only did teachers interact closely with colleagues in brainstorming effective curriculum ideas that would work well for their local community, but students were given as much responsibility as possible in designing and elaborating significant aspects their own

curriculum. "Student choice" was a phrase that several teachers used to describe the curriculum they aspired towards.

In three out of four of the schools in the project, teachers collaborated to design and implement the curriculum. For example, the historical novel project required input from all three teachers in order to design a curriculum that melded Language Arts, honors English, and American History into a collaborative effort which also satisfied all of the teachers' educational responsibilities.

Curriculum under Constant Revision

Once developed, curriculum that derives from such traditional sources as textbooks and state curriculum guidelines tends to stay fixed. In contrast, we have seen how the curriculum of knowledge-building communities remains under constant revision, based on the ongoing experience unfolding in the classroom. The ongoing goals, of course, are constant improvement and relevance to students.

Several of the teachers indicated how they felt it was necessary to constantly revise the curriculum as they saw the needs of students become more apparent. For example both Charles and Cathy expressed misgivings about the historical novel project. They felt that the curriculum needed to be altered in order to encourage more student collaboration and reflection, and to have it be more appropriate to *all* levels of student ability.

Fundamental Changes in Teachers' Roles

When teachers change their instructional practice and their relationship to the curriculum, they tend to also change their role in the classroom. The traditional role of the teacher may be characterized as that of a subject-matter expert whose responsibility it is to: 1) transfer a specific body of knowledge (the curriculum, usually defined as the material in a textbook) to the minds of students primarily through the method of lecture, demonstration, and drill; 2) to evaluate the success of the transfer of knowledge through questioning and tests; and 3) to provide remediation as needed. We have seen teachers in the Knowledge-Building Communities project depart from the traditional role in three ways. First, we have seen a departure from the direct teach approach, so that the teachers use less lecture and demonstration and act more as a learning guide or coach for students who pursue their own knowledge goals. Second, we have seen teachers become less consumers of curriculum and become more involved designing curriculum that is more sensitive to student interests. Third, we have seen teachers becoming less followers of curriculum as they take on the role of directors of curriculum.

Conclusions

This paper provides the findings related to one of five emergent themes identified by teachers who participated in the Knowledge-Building Community Project. In this paper, we have explored how the knowledge-building community requires changes in teachers' instructional practice, their relationship to the curriculum, and the role teachers play in the classroom. In order to support intentional learning, departure from what is commonly

understood to be classroom practice is substantial. No longer are students strictly focused on the teacher who has the responsibility of delivering a curriculum handed down from above. The whole learning community has considerable latitude in defining the curriculum and appropriate instructional activities that further the community's pursuit of knowledge. The profound changes in instruction and curriculum also transform the social interactions among the members of the learning community. In particular, teachers, who, in the past, had isolated themselves within their classrooms and explored only their assigned subject areas, learned to interact more with their colleagues in the knowledge-building communities and expand their curriculum content. Students also experienced their relationships with learning and fellow students as being transformed in substantial ways.

The stories of the nine teachers in the study indicate that innovative technologies to support collaborative knowledge building, coupled with training and support, can serve as a catalyst to changing teacher practices. It should also be noted that implementing a knowledge-building community approach to education can be a difficult uphill battle. At least part of the reason the project fared so well in three of the four schools in the study was because of the "bubble of support" that surrounded the initiative with the status of university and corporate involvement and the fiscal and technical assistance that came with that involvement. Further research is needed to better understand the conditions necessary for the successful diffusion and adoption of the knowledge-building approach to school reform.

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