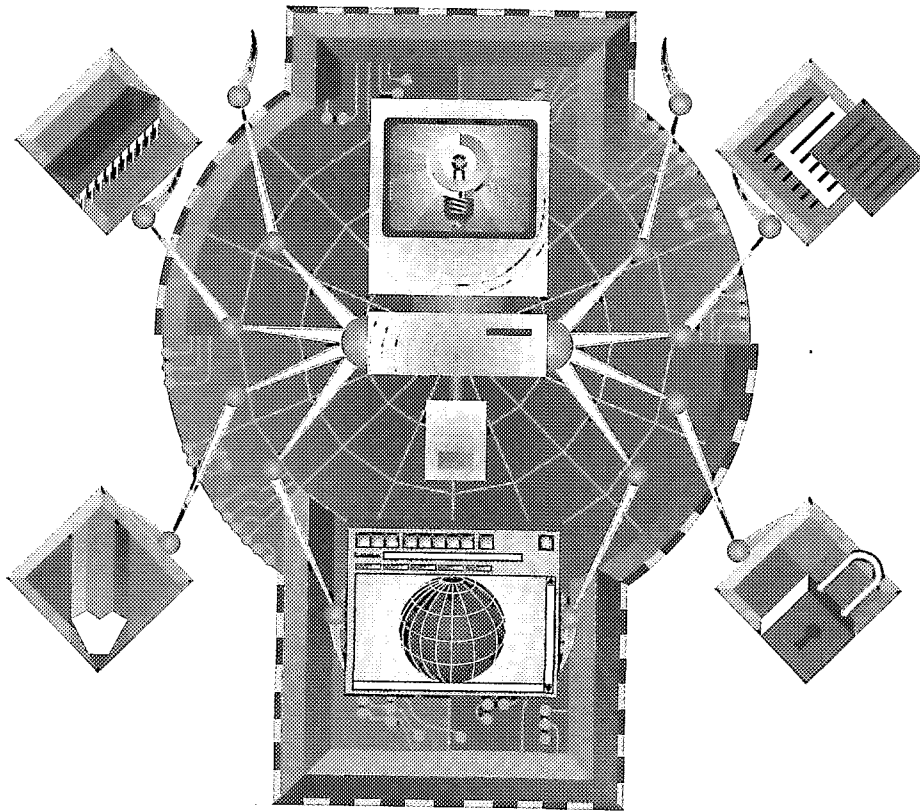


# Enabling Distributed Learning Communities Via Emerging Technologies – Part Two

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**S**UMMARY OF PART ONE FROM THE SEPTEMBER ISSUE: Emerging devices, tools, media and virtual environments offer opportunities for creating new types of learning communities for students and teachers. The defining quality of a learning community is that there is a culture of learning in which everyone is involved in a collective effort of understanding. Transformational learning of 21st century skills requires a strategy of infusing learning communities throughout

students' lives — orchestrating the contributions of many knowledge sources embedded in real-world settings outside of schools, but with teachers still in central roles as facilitators and interpreters. Such distributed learning communities have many implications for teacher education, induction and professional development. To accomplish major changes in teacher preparation, induction and professional development, we must “walk our talk.” If we believe that teaching should move toward educational models such as

distributed learning communities, then we should base its initiatives on similar processes so that the medium of change reinforces the methods.

The first part of this article described a distributed learning community for students based on the emerging technology of multi-user virtual environments. The vignette below depicts an alternative type of distributed learning community — this time based on possible applications of wireless mobile devices to create experiences outside of school that motivate and aid students in developing 21st century skills and knowledge (Partnership for 21st Century Skills 2003). Interfaces for “ubiquitous computing” involve portable wireless devices infusing virtual resources as we move through the real world. The early stages of these “augmented reality” interfaces are characterized by research on the role of “smart objects” and “intelligent contexts” in learning and doing (U.S. Department of Commerce 2003).

The following vignette is based on the concept of “animistic” settings for learning. Animistic beliefs — in which every entity (e.g., trees, dwellings, etc.) is seen as having a resident “spirit” with whom one can interact — have faded from civilization. Now, ubiquitous computing offers a means to create types of animism that are potentially powerful for education. In community-based

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animistic settings designed for learning, smart objects and intelligent contexts can “dialogue” with participants about their history and purpose.

## Augmented Reality and Learning Communities

Alec and Arielle strolled through Harvard Yard on their way to a museum to collect data for their school assignment. Both carried a wireless handheld device (WHD) whose display changed every few feet as they moved past different objects and structures. Also, Arielle, who was predominantly an aural learner, wore a headphone bud so that her WHD could briefly speak to her whenever she was passing something of interest. Every new screen presented an offer from something they were approaching (e.g., an unusual tree, a historic building) to share information about its history and purpose using interactive wireless data transfer. For example, as they approached the “Statue of the Three Lies” (as the sculpture of John Harvard is informally termed), on their handhelds’ screens the statue’s “persona” offered to share with them when he was constructed, whom he represented, and why three distortions of the historical record were involved.

Alec was curious about a particular tree whose age and foliage were impressive. When he accepted its offer to interact, the screen presented information about when it was planted and why, what species of tree it was, and how much longer it might live. The tree also offered to show Alec an image of what Harvard Yard looked like at the time it was planted. Responding to any of these pieces of information led to further prompts offering more information, images, animations, and links to various Web pages about history and botany.

Arielle chose to interact with an interesting building. Through a series of menus and prompts, it offered to describe when and why it was built, what the Yard looked like at that time, its architectural style and architect, the various purposes that it had served over the years, and its current purpose and inhabitants. If she chose, Arielle also could view other people’s messages regarding their feelings and stories about the building, including suggestions about interesting things and people inside. The structure also indicated that another person in the Yard was currently learning about it and offered to ask whether the individual wanted to share impressions with Arielle.

Inside the museum, Alec and Arielle split up to work on their individual assignments. When Alec typed his research topic into the museum computer, it loaded a building map into his WHD with flashing icons showing exhibits on that subject. At each exhibit, Alec could capture a digital image on his WHD, download data about the artifacts and links to related Web sites, as well as access alternative interpretations about the exhibit. His WHD automatically supplied information about Alec’s age and background to ensure that the material he received was appropriate in native language, reading level, conceptual level, developmental stage and learning style.

While the museum-supplied information was interesting, Alec always enjoyed the comments posted about each exhibit by other students. He sometimes added a few remarks of his own to the ongoing discussion. By adding his remarks on-site, Alec gained permission to join the exhibit’s discussion group so that he could continue the conversation off-site and between visits. Seeing a cool artifact related to Arielle’s topic, Alec paused to link to her WHD, then sent her device

a digital image of the exhibit and directional information on its location.

Alec’s favorite exhibits were those augmented by virtual environments. For example, at a panorama showing the bones found at a tar pit, Alec’s WHD depicted a virtual reconstruction of the dinosaurs which were trapped at that prehistoric location. In the virtual environment, he could assume the perspective of each species and walk, fly or swim through its typical habitat. Other types of exhibit-linked virtual environments enabled “time travel” to show how a particular spot on the Earth’s surface had changed over the eons. For each epoch, Alec used virtual probes on his WHD to collect data about temperature, air pressure, elevation and pollutants.

In another part of the museum, sensory probes were available that allowed his WHD to collect data via interacting with simulations involving light, temperature and motion. For example, Alec could manipulate the carbon dioxide levels or yearly rainfall, as well as monitor how plants and animals react to the changes in the environment. In a physics microworld, he could alter the gravitational constant to see how this affected the solar system, using probeware (temperature, light intensity and motion detectors) to measure changes in the sun and planets.

Meanwhile, Arielle was looking at dinosaur exhibits to see how the animals’ structures could generate inferences about how they lived. She observed the skeletons, then watched as her WHD superimposed virtual muscles and skin on its display of the skeleton. Arielle’s WHD then offered her a choice of learning about various aspects of that exhibit. She chose the geological record and saw where this skeleton had been discovered. She then received a message from Alec to visit the coelacanth exhibit

for a surprise. Arielle used her WHD to virtually “mark” her explorations, then followed Alec’s suggestion.

Walking back from the museum, Arielle and Alec shared what they had found. Both wondered what learning was like before augmented reality and ubiquitous computing—when objects and locations were mute and inert. How lifeless the world must have been (Dede, Dieterle and Ketelhut, in preparation).

### Dimensions of Success

As with the virtual environments’ vignette from the first part of this article, achieving such a future requires changes in teacher education, induction and professional development. For instance, as a crucial dimension of classroom learning communities, Bielaczyc and Collins (1999) identify shifts in centrality, peripherality and identity: “The degree to which people play a central role and are respected by other members of a community determines their sense of identity. ... In a learning communities approach, the central roles are those that most directly contribute to the collective activities and knowledge of the community. However, opportunities exist for all community members to participate to whatever extent is possible, and students working in peripheral roles are also valued for their contributions. Centrality and peripherality are context-dependent. Certain students may have more to contribute at a given time, so a student’s centrality can change over time. As members of a learning community take on different roles and pursue individual interests toward common goals, students develop individual expertise and identities. Because diversity is important, an atmosphere in which students respect each other’s differences needs to develop. In contrast, in most classrooms,

students work on the same things and are all expected to reach a base level of understanding. Students tend to form their identity through being measured or by measuring themselves against this base level. Centrality tends to mean those who meet and exceed this base level—those who ‘get it.’”

In a “learning communities” model of education, preparing teachers to assess and value the many dimensions of student success, rather than the single metric of minimum proficiency on high-stakes tests, is an important objective for professional development. To

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help the subpopulations now present in our country’s classrooms reach their full learning potential, building teacher capacity to value diverse perspectives and contributions is vital. This is a much better way than “minimal proficiencies of subpopulations” to conceptualize the dimensions of success that our society should use for educational accountability. The range of perspectives and contributions involved is particularly broad in distributed learning, which draws on multiple types of expertise and cultural knowledge from community resources outside of the school.

Another important dimension cited by Bielaczyc and Collins (1999) is the

altered role of knowledge in learning communities: “In learning communities, the development of both diverse individual expertise and collective knowledge is emphasized. In order for students to develop expertise, they must develop an in-depth understanding about the topics that they investigate. Rich subject matter is important. The topics are not randomly chosen, but rather the depth centers on key principles or ideas in a domain that are generative for understanding a broad array of topics. There is also a circular growth of knowledge, wherein discussion within the community about what individuals have learned leads individuals to seek out further knowledge that they then share with the community. Thus, there is an interplay between the growth of collective knowledge and of individual knowledge, with each supporting the other. In most classrooms, the goals tend toward covering all the topics in the curriculum (breadth over depth) and for everyone to learn the same thing.”

This also has implications for teacher education, induction and professional development, as the collective knowledge in a distributed learning community involves contributions from remote participants and includes types of content for which teachers have no formal preparation. The inclusion of multiple sources of expertise is potentially an important aid for teachers in responding to the many kinds of sophisticated exploration that inquiry-based learning for 21st century skills involves. However, professional development must expand a teacher’s capacity to serve as a facilitator, guide and model of learning how to learn, rather than as a sage who is the single source of knowledge.

Overall, successfully implementing new educational approaches in typical classrooms is very challenging. This is

particularly true for technology-based innovations in which the wide-ranging capabilities of current computers and telecommunications, their rapid evolution, and the special knowledge and skills required of users pose additional barriers to effective utilization. In addition, shifting to facilitating the learning of 21st century skills via inquiry-based pedagogy centered in learning communities is difficult for many teachers, because this poses a set of instructional challenges and opportunities very different from inculcating rote acquisition of facts and recipes.

Many current approaches to teacher preparation, new teacher induction and continuing professional development are clearly inadequate to achieve the goals expressed in the earlier vignette. Yet, these visions reflect the type of education our next generation of children must have to prepare for work, citizenship and self-fulfilled lives, as well as the types of media literacies and mediated learning styles that they will bring into the classroom. The vignette also illustrates an innovative strategy for schooling that might attract a much broader range of skilled and committed people to the profession of teaching. Such an outcome would, in itself, provide substantial leverage for educational improvement.

### The Next Steps

To accomplish major changes in teacher preparation, induction and professional development, such as those outlined above, we must “walk our talk.” While valuable, activities such as issuing reports, holding conferences and writing articles are inadequate to accomplish the scale of changes required in our society’s rethinking of learning, teaching and schooling. Especially if we believe that teaching should move toward educational models such as distributed

learning communities, all of us should base our initiatives on similar processes so that the medium of change reinforces the methods. What nascent examples of distributed learning communities might guide these design efforts toward such an innovation strategy? For reasons of space, just two illustrations are sketched below.

As an experiment in teacher learning communities across distance (without a face-to-face component), an Inquiry Learning Forum was created at Indiana University for math and science teachers across the state who were interested in

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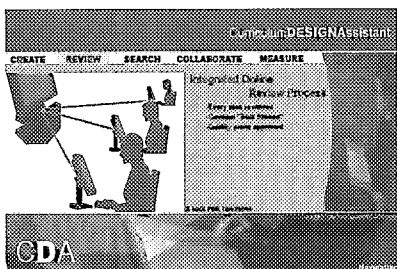
guided inquiry teaching. This Web site (<http://ilf.crlt.indiana.edu>) contains many types of support for professional development via distance learning — from video case studies to virtual communities of practice.

Studies indicated that the Forum was effective in many ways, but a face-to-face component would have increased its value and impact (Barab et al. 2001). Research such as this can help in developing second-generation distributed learning communities to prepare the critical mass of skilled teachers essential to achieving major improvements in student learning outcomes, the organizational redesign of schools, and other innovations crucial to education for the 21st century.

As a second example, the Milwaukee Public Schools’ (MPS) Professional Support Portal ([www.milwaukee.k12.wi.us/pages/MPS/Teachers\\_Staff/Tech\\_Tools/Portal](http://www.milwaukee.k12.wi.us/pages/MPS/Teachers_Staff/Tech_Tools/Portal)) is an emerging design for new teacher induction and retention based on a distributed learning communities model (Dede and Nelson, in press). Since more than 10% of the district’s teachers leave each year, and 37% of its new teachers leave within their first five years, unacceptable instructional conditions result. Students, often those with the greatest needs, are being taught by rookies year after year. Aided by researchers at the Harvard Graduate School of Education and by the Education Development Center, the Professional Support Portal (PSP) is a district initiative to advance and accelerate the effectiveness of new teachers, as well as to reduce the attrition among new teachers. The development of the PSP is based on a distributed learning communities design process (<http://gseacademic.harvard.edu/~mps>).

New teachers’ needs center on access to high-quality teaching and informational resources, frequent interaction with expert mentors and coaches, and ongoing peer support. In response, the portal project has created a convergence of several learning tools:

- The **MPS Curriculum Design Assistant (CDA)** is a tool that emerged from the district’s work with Replicable Schools as initial test beds. Teachers are asked to blend many agendas into meaningful student work as various directives reach teachers from the state, the district, professional organizations, their principal, the community, colleagues, their union, etc. Conventional district curriculum support operations were having little impact in helping teachers with these many agendas. To aid with this situa-



tion, the CDA creates a collaborative environment where teachers are able to post and find lessons that support their daily classroom work. This Web-based tool is accessible all the time, every day of the year, at [www.milwaukee.k12.wi.us/pages/MPS/Teachers\\_Staff/Tech\\_Tools/CDA](http://www.milwaukee.k12.wi.us/pages/MPS/Teachers_Staff/Tech_Tools/CDA). When used in the creation mode, the CDA guides its users through lesson-design options that are research proven, searchable and standards-based. State and district standards also are readily available in the lesson-design process, wherever and whenever the work is taking place.

- **Teachscape**, a commercial professional development process based on video case studies, provides examples of standards-based lessons being taught in urban classrooms at the elementary level (<http://ts2.teachscape.com/html/ts/public>). These video artifacts of good teaching in typical settings showcase quality instruction, highlight the components of sophisticated pedagogies, and provide opportunities for individual and collective reflections.
- **Tapped In**, a nonprofit multi-user virtual environment for professional development, provides an online social context where educators can build and sustain communities of practice (<http://ti2.sri.com/tappedin>). Teams of teachers can interact in a shared work space without driving to a common meeting site. Also, at anytime, when face-to-face support is not available, teachers can go online for intellectual

and emotional support via virtual interactions with peers and mentors.

An emerging version of the MPS Portal is under development at <http://mpsportal.milwaukee.k12.wi.us>. Formative design feedback from new teachers is encouraging, and large-scale evaluation studies are in progress (Dede and Nelson, in press).

These examples, and similar initiatives, provide guidance for designing a distributed learning communities process. Specifically, the emphasis on community identity in both the Inquiry Learning Forum and in Milwaukee’s PSP is consistent with what Bielaczyc and Collins (1999) note about classroom learning communities: “In a learning communities approach, there is also the notion of a community identity. 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’ develops. In the absence of a learning culture that builds a collective understanding and views its members as learning resources, most classrooms fail to develop a strong sense of community identity.”

To accomplish its objectives, we need to build a large, widespread professional community whose identity centers on a common vision and commitment to improving teaching, learning and schooling. In conclusion, the fundamental barriers to employing new technologies effectively for learning are not technical or economic, but psychological, organizational, political and cultural (Dede 1998). For example, current regressive policies such as the No Child Left Behind initiative, widely touted as “educational reform,” pose the most substantial barrier to schools and teachers

using learning technologies effectively (Dede 2003). In addition, these policies worsen inequities in our society by penalizing the many students who have atypical learning styles that require non-presentational pedagogies. Distributed learning communities provide models of teacher education, induction and professional development that move beyond technical literacy and curriculum integration into reconceptualizing content, teaching, learning and assessment.

However, even teachers with all of these skills are now severely handicapped in using learning technologies effectively. This is because they must race through a huge body of presentational material to meet broad, shallow state curriculum standards and prepare their students to do well on low-level, high-stakes tests. Powerful new models for teacher preparation, induction and professional development—as well as for evolving the public’s conceptions of learning and schooling—are essential to take full advantage of the opportunities new technologies pose. To meet this challenge, all of us in teacher education should lead the way with improvement initiatives based on a distributed learning communities process of innovation. THE

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For information about the Harvard Graduate School of Education’s hand-held initiative, visit <http://gseacademic.harvard.edu/~hdul>.

Acknowledgements: *This article is modified from a study commissioned by the National Commission on Teaching and America’s Future and published in the proceedings of the 2004 Society for Information Technology and Teacher Education Conference.*

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SOURCE: T.H.E. J 32 no3 O 2004  
WN: 0428300462004

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