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Evolution of an On-line Education Community of Practice

Mark S. Schlager Judith Fusco Patricia Schank
SRI International

> [Teachers] have no time to work with or observe other teachers; they experience occasional hit-and-run workshops that are usually unconnected to their work and immediate problems of practice. [Effective professional development cannot] be adequately cultivated without the development of more substantial professional discourse and engagement in communities of practice. — Darling-Hammond & Ball (1997)

> One important role for technologies is as the backbone for an invigorated, vibrant professional community among educators. This will not happen, however, without considerable effort to design the technologies and the social structure of their use with this objective made explicit. — Hawkins (1996)

The concept of *community of practice* has become a major theme of teacher professional development (TPD) research and practice. Advocates argue that communities of practice (CoPs) can be powerful catalysts for enabling teachers to improve their practice (Lieberman, 1996; Rényi, 1996). A growing body of TPD policy research (e.g., Loucks-Horsley, Hewson, Love, & Stiles, 1998; Darling-Hammond & Ball, 1997) is beginning to converge on a common set of effective professional development characteristics that stem largely from CoP concepts. For example, Lieberman's (1996; Lieberman & McLaughlin, 1995) research on teacher networks builds on CoP concepts of social networks (Wellman, 1997) and community gathering place (Oldenburg, 1997). Lieberman (1996) describes how informal retreats and dinner meetings help build professional relationships and socialize new members into the fold, thereby solidifying teachers' commitment to the community.

Professional development approaches that embody CoP characteristics (e.g., teacher collaboratives, subject-matter networks, professional development schools, and school-university partnerships) have proven successful in local TPD reform projects (National Science Foundation, 1997; Stokes, Sato, McLaughlin, & Talbert, 1997). Unfortunately, few local reform efforts have been able to sustain momentum beyond the life of the outside funding (Bush, 1997; McLaughlin, Mitra, & Stokes, 1999) or to scale up to meet statewide needs (Corcoran, Shields, & Zucker, 1998). Most TPD programs still take the form of traditional inservice days or workshops that do not reflect the characteristics and approaches of effective TPD suggested by research.

Although the TPD policy literature has not focused on technology's role in transforming, sustaining, or scaling up CoP-based TPD efforts, the studies cited above can be interpreted as providing a set of design requirements for developing a technology infrastructure to support TPD efforts that are transformative, sustainable, and scalable. State and local governments are spending hundreds of millions of dollars to install computers and network access in all classrooms and many more millions to train teachers to use the technology. Education technology research suggests that TPD and education reform programs can help leverage investments in school technology and the cultural incentives of "getting on-line" by employing Internet technology in the

service of on-line CoPs for education professionals (Hawkins, 1996; PCAST, 1997; Becker, 1999; Pea, 1999). However, neither large investments in technology nor on-line TPD projects have reliably resulted in the kind of on-line community that is sustainable enough to support inservice teachers as they engage in the 3- to 5-year endeavor of classroom reform or scalable enough to support teachers as they enter the profession and grow professionally toward mastery (Corcoran et al., 1998). We believe that this failure is due to the absence of effective models for both on-line professional development and on-line community.

In this paper, we provide an overview of an on-line CoP model that is designed to carefully match Internet technology affordances (and constraints) with effective CoP-based community-building and professional development strategies. Our goal is to evolve a sustainable, scalable CoP for K-12 education professionals as they learn the ropes of their profession, implement new practices, and apply new content knowledge. We provide evidence of how our on-line CoP model supports both TPD providers and teachers as the community has grown and evolved over the past 3 years. We conclude with a discussion of attributes that lead to scalable, sustainable on-line education CoPs, and of the roles such CoPs can play in systemic reform projects.

Taking Communities of Practice Concepts On-line

Three years ago, we set out to establish an on-line TPD research testbed that could scale to support thousands of teachers' professional activities while forging the kind of professional community that TPD policy researchers have found to undergird successful local school reform efforts (e.g., Little, 1994; Lieberman, 1996; Darling-Hammond & Ball, 1997; Loucks-Horsley et al., 1998). We have drawn many of our ideas and design guidelines from the CoP literature.

Brown and Gray (1995) define workplace CoPs as small groups of people held together by "a common sense of purpose and a real need to know what each other knows." George Pór (http://www.co-i-l.com/coil/knowledge-garden/cop/definitions.shtml) describes a CoP as "more than a 'community of learners,' a community of practice is also a 'community that learns.' Not merely peers exchanging ideas around the water cooler, sharing and benefiting from each other's expertise, but colleagues committed to jointly develop better practices." In the CoP literature, learning is viewed as a social activity that occurs as newcomers and journeymen move through an established community's professional hierarchy toward expertise (Brown & Duguid, 1996; Lave & Wenger, 1991; Wenger, 1998). Learning opportunities occur primarily through informal interaction among colleagues in the context of work. Newcomers gain access to the community's professional knowledge in authentic contexts through encounters with people, tools, tasks, and social norms. New practices and technologies are adopted by the CoP through the evolution of practice over time. Thus, a CoP can be an effective *hothouse* in which new ideas germinate, new methods and tools are developed, and new communities are rooted. The CoP can help professionals gain access to, and facility with, ideas, methods, content, and colleagues; help novices learn about the profession through apprenticeship and peripheral participation; and enable journeymen to become valued resources and community leaders through informal mentoring and participation in multiple work groups.

On the surface, the characterization of CoPs as relatively small groups of people in a single workplace appears inconsistent with the goal of supporting large numbers of teachers engaged in learning new practices across grade levels, subjects, and organizations. We believe, however, that the two can be quite compatible. Members of a professional CoP often come from a larger network of colleagues spanning multiple organizations, drawn to one another for both social and professional reasons. A recent study by Andersen Consulting of on-line CoPs in several large corporations found that such CoPs work best as catalysts for innovation and learning when they exist outside the institutional controls and constraints of individual organizations (Cothrel & Williams, 1999). CoPs that cross organizational boundaries can grow and evolve over time as groups form and disband, projects begin and end, and individual members participate actively for a period of time, go dormant, and then find new opportunities to participate. Through organic growth, an on-line education CoP can achieve the economies of scale, diversity, and informal communication channels needed to spread innovation and become an ever-widening source of expertise.

TAPPED IN On-Line Environment and Education CoP Model

In most workplaces, professionals have access to several computing and communications tools and workspaces that (a) support work practices of large numbers of different groups; (b) enable users to know whom they are interacting with and what is going on around them; (c) allow users to create, store, and share discourse objects (e.g., notes, overhead slides, web page bookmarks); (d) communicate in real time or asynchronously as the need arises; and (e) engage in group activities hosted by organizations as well as their own circle of colleagues. At the outset of our project, we recognized the challenge that the lack of technologies that are commonly available to CoPs in other professional fields presents for an education CoP. Telephones, fax machines, private offices and meeting rooms, document and enterprise servers, and video conferencing are rare among teachers. However, just as professional CoPs outside of education are making more and more use of the Internet, intranets, and enterprise portals for communication (Constant, Sproull, & Kiesler, 1997) and information management (Cothrel & Williams, 1999; Murray, 1999), so can education CoPs (e.g., Schofield, Davidson, Stocks, & Futoran, 1997). Access and bandwidth are still limiting factors, but they are no longer insurmountable barriers (Becker, 1999; CEO Forum on Education and Technology, 1999).

Our challenge was to instantiate the CoP affordances enumerated above as best we could within the constraints of most teachers' environment—no private offices, telephones, or high-bandwidth technologies, with only basic access to the Internet. The result is a work in progress called TAPPED IN (TI). TI is an on-line education CoP where educators can attend activities hosted by a variety of education organizations, conduct their own on-line activities, or expand their circle of colleagues by participating in communitywide activities. The technology underlying TI is a platform-independent, Web-enhanced, multi-user virtual environment designed to support the needs of education professionals and TPD organizations over time (see Schlager & Schank, 1997, and Schank, Fenton, Schlager, & Fusco, in press, for a more complete technical description). Activities occur (in real time or asynchronously) in virtual rooms that provide a basic set of communication mechanisms (speaking, whispering, paging, nonverbal actions) and support tools (e.g., virtual whiteboards, sharable text

documents, Web page projection, transcript recorders).[1] As technology in schools advances, we add new capabilities.

In concert with our technology development, we have evolved a two-pronged approach to cultivating an on-line CoP (described in more detail in Schlager, Fusco, & Schank, 1998/1999). First, we invite organizations that serve teachers or other education professionals (e.g., school librarians, principals, district staff) to be *tenants* in the TI environment and use it to help accomplish their own TPD agendas. We recognize their expertise in TPD content and pedagogy, and they rely on our environment and on-line collaboration expertise. Second, because TI is not dedicated solely to one project or organization, we actively encourage any individual education professional or small group to join, help shape, and take ownership of the community. We host on-line communitywide activities to help acculturate nonaffiliated members to the community, and we provide services to help them create their own learning experiences.

Our current tenants include nationally recognized education organizations (e.g., Lawrence Hall of Science, Wiesenthal Museum of Tolerance, American Association of School Librarians), educational Web site hosts (e.g., Swarthmore College Math Forum, ED's Oasis), teacher preservice and master's degree programs (e.g., Pepperdine Univ., Univ. of Illinois), and state and local education agencies (e.g., Kentucky Department of Education, Los Angeles County Office of Education, New Haven USD, Joint Venture: Silicon Valley Challenge 2000). By offering their TPD services in TI, the organizations enable their affiliated teachers to gain access to expertise, ideas, and resources (human *and* information) that no single organization could provide by itself. In return, the organizations receive support from the TI staff and from each other as they learn how to work effectively with teachers on-line. They also gain access to a cyber-ready pool of participants for their programs. Together, our members (more than 5,800 as of October 1999), tenant organizations (15 as of October 1999), and their activities make up the fabric of our CoP.

Consistent with CoP research, the primary catalyst for our growth is teachers' changing roles and contexts. For example, Pepperdine University School of Education students graduate and go into leadership positions in local and state education agencies. Lawrence Hall of Science summer institute attendees become resources for other science teachers in their districts. In these new roles, they bring more teachers into the community. Even a single workshop class visit to TI can result in a cadre of new members. One member describes his experience that led to his introducing 65 of his colleagues to TI:

> This all started with my exposure to Tapped In in [professor's name] Instructional Technology classes at [name] University… I did a one-credit independent study with [professor] as part of the course where I worked with a couple elementary science teachers for content support. In my work in these courses I would occasionally talk about Tapped In. Twice each month, throughout the school year, [name] our supervisor for library and

[1] The reader is encouraged to see http://www.tappedin.org/info/webtour.html for an illustration of the graphical user interface or to simply log in.

> information services in [school district], holds a countywide meeting for our school-based library media specialists (one for secondary and one for elementary). One day, [colleague's name] suggested that we should hold one of our countywide meetings in Tapped In. The January meetings were targeted. The rest is history.

In the 3 years since TI opened, we have seen many groups come and go without jeopardizing the growth of the community. Several of our early tenants have dropped out of TI, but each has left behind a small proportion of affiliated teachers who have remained active and brought in new members in new contexts. For example, we recently received an e-mail from a member who joined as part of a summer institute in 1997. She is now leading her own TPD project and is training a new cadre of teacher to use TI in the same suite of rooms that her old cadre used in 1997. She writes (edited):

> We've dedicated the [old room] in the [old project] suite to this project since we learned about TI to be able to do this [new] project. Folks on Saturday liked the idea of having a place of their own to meet. And that's not even counting their own virtual offices which they also relished. You do a real service to public school teachers by allowing them their own offices!
>
> We're using TI to continue to teach the solar astronomy of this project. Participants will work with staff at [university] to learn to operate [university's] telescope remotely. They'll have remote astronomy software running on the Web and will talk to staff on TI as they maneuver the telescope from their school. Since few have access to long-distance phone lines at school (and their principals would balk at the cost of the phone calls), but they all have Internet connections, TI makes the instruction possible.
>
> We'll also use TI to work on three-person investigations using a multi-media program called Astronomy Village. Each person takes an assigned role; TI will allow a group to confer about their progress and where the investigation will head next. I'm so psyched about this part that I'm going to participate in one of the groups.
>
> And Thursday, I'm teaching my husband, dean and professor at [another university], how to use TI. I've been singing its praises and want him to see the possibilities. By the way, the help desk person Saturday and Sunday morning was awfully nice.

Another sign of TI's evolution as a CoP has been our growth both in numbers of members and in rate of participation since we began collecting data in February, 1997.[2] During this period, our membership (Figure 1) and monthly log-in rate (Figure 2) have grown steadily in proportion to one another. Approximately 15% of the total

[2] Although our grant funding, partnerships, and summer training workshops have been responsible for much of our growth, we must also acknowledge a wave of events and advances that we were fortunate enough to ride. These included ISPs offering free e-mail accounts, Java-enabled browsers (which boosted our user interface capabilities), and rapid increases in processor speed and Internet access bandwidth in schools and at home.

membership log in per month, on average, no matter how large the community. TI members tend to be active for a period of time and then go dormant for some time before logging in again, as illustrated by the following e-mail from a long-dormant member who wanted to attend an upcoming event:

> I enrolled in Tapped In sometime last year. I received a character and a pw from TI, but then had a lot of work to do at school and haven't visited in probably 6 months…. When I visited this time, I couldn't access my character so went in as guest.... Could you please up-date my pw and give me any other updating info. I might need.

Another indicator of CoP health is the ability to attract a population with diverse interests and expertise within the profession. Approximately half of our members describe themselves as K-12 teachers. The balance is composed of librarians, researchers, university faculty and graduate students, staff developers, school support and administration staff, preservice teachers, and "other" (Figure 3). The proportions have remained relatively steady as the community has grown, indicating that we continue to attract a diverse range of new members as we grow. Below we provide additional evidence of the utility, sustainability, and scalability of the TI CoP model over the past 3 years.[3] We begin with a summary of some of the first data we collected in TI, data without which we could not proceed in growing the community.

Evolution of Group Discourse Norms and Skills

TI was founded on the basic premise that teachers could engage in professionally meaningful and productive discourse on-line. We therefore had to demonstrate not only that teachers could converse socially (chat rooms are full of teachers) or post messages (teacher newsgroups and listservs abound) via text, but that they could achieve the same types of group objectives as they could in face-to-face meetings (e.g., brainstorming, decision-making, informing, knowledge building). We began by experimenting on ourselves, using the environment as the primary means of communication among our research team.

Our research group consisted of 12 members, including TI developers with considerable experience in on-line synchronous communication and researchers who had not previously used TI or any similar system. Members of the group were widely dispersed geographically. Biweekly meetings occurred regularly throughout our first year. As with any newly formed multidisciplinary group, we had to learn each other's jargon and interpersonal styles. We also had to develop our own norms for interacting as a group. We were all used to the social constructs of face-to face meetings—rapid-fire dialogue, long monologues, whispered side comments, topic shifts—and the skills needed to break into the dialogue at just the right moment or guide a meeting through the items on an agenda. We had to learn how to replicate these elements of meetings and group dynamics by expressing ourselves through a very narrow-bandwidth medium: typing lines of text.

[3] We do not address in this paper the issues of financial sustainability or technical scalability, both of which we recognize as critical to the success of the model.

An analysis of the transcripts from our meetings revealed many episodes of knowledge building, mentoring, and argumentation and resolution, all key characteristics of productive group work (see Derry, Gance, Gance, & Schlager, in press). Our discourse was not without instances of miscommunication, confusion, and frustration at the pace of progress, but our ability to function as a team on-line more and more effectively over time suggested to us that staff developers and educators could also hold productive meetings on-line.

Discourse Analysis of On-line TPD Meetings

To test our conjecture, we analyzed the on-line meeting discourse of participants in a TPD project designed to help high school and community college teachers learn new tools and strategies for teaching earth and space science. The TPD project began with two 2-week summer institutes in July and August 1997. Seven teams of two to four high school and/or community college teachers attended each institute to gain hands-on experience with software and techniques used in earth and space science. They received TI training on one morning of the institute. The teachers' objective during the institute was to begin to develop plans for inquiry-based learning projects that they would ultimately implement with their students. The project director decided to conduct periodic on-line meetings with the 14 teams over the course of the school year to obtain updates on their progress in the classroom.

Project staff held three sets of real-time meetings in TI, in October 1997, January 1998, and May 1998. At least one representative from each of the 14 teams was asked to log in and report on their progress, obstacles, and lessons that they wanted to share with other teams. Transcripts of all the meetings were collected via TI's automated transcript logging mechanism and analyzed by research staff. The participants gave us permission to have their on-line meetings recorded for research purposes. The TPD project ended after the May sessions.

Our primary goal was to determine whether the cohort could conduct its business through on-line meetings and how the discourse evolved over time. We were also interested in how the dialogue might be affected by extraneous social conversation and by technology constraints, two factors that have led to criticism of text-based conversation in chat rooms. A coding scheme was developed to quantify the structure and flow of the on-line meetings, based, in part, on studies of face-to-face dialogue in collaborative design group meetings (Olson, Olson, Carter, & Storrosten, 1992). We coded each utterance (and nonverbal action) as an instance of one of seven categories of discourse. The transcripts were read by two researchers, who applied the coding scheme independently and then came together to calibrate their findings. Differences between the two coders' ratings were resolved by a third reviewer. Here we summarize our findings from the four most frequent categories of discourse:

- Business focused — Comments related to a meeting agenda topic or other project-related point of discussion.
- Meeting management — Comments and actions related to the scheduling, meeting norms, meeting roles, follow-up, and structure of the meeting, including who is in attendance or absent or whose turn it is to speak.

- Technology related — Comments related to the use of TI or other on-line technology, including technology complaints and praise, questions, and answers to technology questions.
- Social — Social conversation not related to the specific business at hand, including greeting and exiting pleasantries, jokes, and digressions.

According to Olson et al. (1992), a typical face-to-face meeting consists of approximately 50% to 60% business-focused utterances supplemented by social and meeting management dialogue. Our data show that the on-line meetings approached this benchmark over time (see Figures 4 and 5). The relative proportion of business-focused entries increased from an average of 25% in October to about 50% in May. In the October and January meetings, the proportion of business-focused entries by meeting leaders as a function of their total entries was about 10% to 15% lower than the proportions of teachers' entries. By May, however, both leaders (Figure 4) and teachers (Figure 5) were devoting 50% to 60% of their entries to business-related topics, indicating that they were engaged in a balanced dialogue.

As expected, technology-related utterances were highest in October and declined in overall proportion to a steady rate of approximately 5% of all utterances as the users gained experience with the system. The transcripts show that technology-related entries did not decline further because new users attended the January and May meetings; they had to overcome some of the same difficulties that participants in October had already overcome. Figures 4 and 5 also show that leaders and teachers engaged in roughly equivalent proportions of social conversation across meetings, indicating that social conversation in the context of professional meetings is independent of familiarity with technology. As in face-to-face meetings, attendees greeted one another before the meeting was called to order, engaged in collegial banter, and often stayed behind at the end of a meeting to converse.

Finally, meeting management utterances were highest in the first set of meetings, when the GSA leaders were inexperienced at moderating an on-line meeting and the teachers were inexperienced in participating in one (much cross-talk was observed early on). A spike in meeting management utterances was observed in the first January meeting for the meeting leaders (Figure 4) because of a change in meeting management style introduced by the leaders to improve the flow of the meetings. After that meeting, the percentage of time leaders spent on meeting management declined to 10% in the final meeting, in accordance with patterns found by Olson et al. (1992) in face-to-face meetings. The decline in meeting management can be attributed to the development of (a) effective on-line meeting leadership skills and (b) group norms for on-line communication as the teachers became more familiar with each other, the style of communication, and the technology. We were particularly pleased to see that the proportional decline in meeting management by leaders was replaced by an increase in business-focused utterances.

The analysis showed that the meetings held in TI were in many ways similar to meetings held face to face. In both modes, meeting leaders attempt to keep the discussion on task to get through an agenda. Multiple threads of conversation emerge; some are carried through to conclusion, and others are not. Participants sit through presentations, holding whispered side conversations as they await their turn to present.

New participants arrive late, disrupting the flow of conversation while they greet the others. In face-to-face meetings, presenters complain about computer and projection devices not working or traffic delays in getting to the meeting. In TI, participants complain that they lost their connection or their ISP is slow.

Face-to-face and on-line meetings also differ in important ways. For example, in face-to-face meetings, there are visual and auditory cues and social taboos that prevent people from talking over one another, ignoring a question, or holding unrelated conversations. Such conventions must be relearned in on-line discourse, as illustrated in the following excerpt from one of the meetings. DonB is taking his turn presenting to the group. The meeting leader is Heather. Karla has been typing what she is going to say in her presentation and discovers that she does not know how to save what she has typed and participate in the current conversation without blurting out what she has typed to the group. She decides to barge in:

> DonB says, "I have used the internet for info on earthquakes, weather.... In fact my students sucessfully predicted the storm we are experienceing at the moment. We have also done several execises using GPS"
>
> FrancisB says, "did you have the students work in groups or as individuals?"
>
> KarlaW says, "Can I barge in now? I finished typing something. And I don't know how to split it up with this request. Keep addressing Don if you want. I spent some time with the Tapped in folks in Menlo Park CA earlier this month as a representative from….[the utterance goes on for several more sentences]
>
> HeatherU says, "Point of order... lets give Don feedback first, then we can move on to Karla's report which was projected. We'll give her a chance to "talk; too. "presenters" let us know when you are done reporting out too. thanks.

Over time, the meeting leaders learned to orchestrate meetings effectively, and the teachers were shown how to queue up their presentations, resulting in organized, business-related discourse. Social banter that is characteristic of collegial groups was present but did not interfere with the meetings. Although the quality of discourse improved over several months, we believe that it could have improved much faster if the group had (a) begun meeting sooner following the summer institute, (b) met more frequently, or (c) had prior experience with on-line discourse. The lessons we learned from this experience have helped other groups in the community hold productive meetings more quickly. Moreover, TI members who have learned the ropes of on-line discourse in one context have been able to transfer those skills and group norms to new groups and contexts, making their initial investment more valuable over time.

Evolution of TI Community Services

Approximately half of our members and scores of small, local educator groups across the country have found TI through a Web search, listserv, newsgroup, or colleague's suggestion. TI enables these members (as well as those who are affiliated with a tenant) to derive value through community support services and activities that we and the members themselves organize. These activities not only enable members to receive assistance when needed, they also enable members to serve as resources for other members. Through the process of acculturation to the community, on-line tools and

practices become part of a teacher's palette of teaching and learning skills, and teachers gain the confidence to work collaboratively on-line.

We have developed several ways to scaffold members in that process, including our real-time Help Desk, *After School Online* discussions, and *MeetMe* mailing list. Our goal is to help users progress from novice to participant to leader in the community. Our key to achieving this goal is our Community Director, who devises the activities and services that people keep coming back to TI. The Community Director role includes event organization, volunteer recruitment, mentoring, and technical support (and, in our case, also research). The Director must continuously take the pulse of the community, plan new activities, and provide new services. Below, we describe some of her accomplishments.

Community Help Desk. Scores of guests and new members log into TI each week. Although some have been through TI training or are experienced enough in Internet environments to figure out how to communicate and get around within a few minutes, most are not. New members need to learn the ropes, and in our CoP model, more experienced members show them through their own example. The Help Desk is often the first helping hand that new members receive as they learn the ropes, as illustrated in the following e-mail sent from a teacher in Cleveland to her colleagues after logging in to practice before her first on-line meeting:

> I don't know if anyone has visited TAPPED IN yet. I spent my lunch hour today doing just that. Mostly, I was getting acquainted with how it worked. It was really neat that teachers from Kentucky, Pennsylvania, and Indiana were there with me. There was someone else online with us, BJB. He/she was someone designated to help new users and answer questions. My first visit was not only painless but enjoyable. The bell, ending my lunch period, seemed to ring too quickly. What was funny was, that as I was typing about how the bell had rung and I had to go . . . two other teachers typed the same thing! I had this picture of the whole Eastern United States changing classes at the same time!

We began the Help Desk by posting one of the TI staff in Reception (where people land by default when they log in) during business hours to answer questions, offer tutorials, and give tours. We soon found that (a) we were not able to sustain the service staffed only by the researchers *and* do any research, and (b) many members began to "hang out" with the Help Desk staffer in the reception area. Seeing an opportunity, we began to actively recruit veteran members of the community to volunteer as Help Desk staff. The volunteers "apprentice" to an experienced staffer for a period of time until they feel comfortable "holding down the fort" on their own. Help Desk staff often share tips, FAQs, and notes that they have written to answer common questions. The following (edited) transcript illustrates how a guest (Kathy) is greeted, in this case by a staff member (Marty), a volunteer (Charlie), and an apprentice (Carol):

> Marty waves hi to Kathy
> Marty [to Kathy [guest]]: "can I answer any questions for you?"
> Kathy [guest] says, "Do I have to be in a room ?"
> Marty [to Kathy [guest]]: "you ARE in a room called Reception"

Kathy [guest] asks, "Where is everyone and is anyone discussing University requirements for a FL?"
Marty whispers, "type WHO to see all the people who are currently logged in and their location" to Kathy [guest].
Charlie asks, "FL?"
Kathy [guest] asks, "Thanks Marty. Who are you?"
Kathy [guest] says, "Charlie - foreign language"
Charlie says, "I'm Charlie xxxxxxx"
Marty [to Kathy [guest]]: "I work here at TAPPED IN. Charlie is a Spanish teacher
Charlie says, "I'm leading a group right now that is learning to use Tapped IN"
Charlie says, "Hola"
Marty [to Kathy [guest]]: "maybe charlie can help answer your question"
Kathy [guest] says, "Hola Charlie. Un amigo me dijo que hoy iba a tener una discusin entre maestros de espaol."
Kathy [guest] says, "Id like to discuss what colleges are doing in the way of placement tests in Spanish. My darlings think they take two years and veg."
Marty [to Kathy [guest]]: "right now, this is the place to be. Charlie is busy with 10 teachers of his own right now so he will take a while to answer you"
Charlie says, "Kathy, I'd like to invite you to a discussion group at 2:30 pm about FL teaching"
Charlie projects Agenda.

Foreign Language Discussion Group 11/18 Agenda
2:30 Welcome, introductions and ground rules.
3:00 Input on discussion topics for this group. Everyone is welcome to say what they want to discuss. Charlie will share material on Keypals and Project-based learning.
3:30 Coloquio en espa ol para profesores

Kathy [guest] asks, "I'd like to practice before then. What do I need to do?"
Marty [to Kathy [guest]]: "for the meeting, you only need to talk. we have a few ways to talk. Carol will help you learn them"
Carol [to Kathy [guest]]: "I can help you with some of the basics before the meeting."
Carol [to Kathy [guest]]: "We can go to the After School Online room -just type aso"
Kathy [guest] says, "Thanks Marty. Hi Carol"
Kathy [guest] leaves for the ASO.
Carol leaves for the ASO.

Variations on this scenario are played out several times each day in TI, not only by staff and volunteers but by the members themselves. We believe that the Help Desk is one of the key factors in TI's success. Teachers tell us that we are the only resource on the Internet where they are greeted personally with an offer of assistance when they log in.

After-school discussions. Another example of how we are scaffolding the community as it develops its own activities, social norms, and identity is our *After School Online* (ASO) discussion series. ASO is a weekly series of hour-long real-time discussions on topics suggested by the community and led by volunteers recruited from the community. Education organizations and independent consultants also hold ASO sessions to publicize their projects and interact with teachers. The topics for the month

are announced to all TI members via an e-mail newsletter and on a Web calendar. Those wishing to participate simply log in at the scheduled date and time. ASO is evolving into an important way to indoctrinate new members, a dissemination mechanism, and a way to help new or potential partner organizations learn how to use TI effectively.

ASO has no full-time discussion moderator; members of the community learn to conduct their own on-line sessions from participating and observing their peers. Each session begins with introductions. The leader prepares a series of notes about the topic (as is done in "brown-bag" seminars) in advance and projects them (like overheads) to the participants as conversational props. They are also able to project a Web page to the computer screens of others (who are using our TAPestry Java client) to lead a virtual Web tour.

Typically, sessions have attracted 3 to 8 participants, a size that is manageable for a novice leader. In the first 10 months of the program (11/97 through 8/98), a total of 492 members and guests (181 unique people) attended 86 ASO sessions on over 40 wide-ranging topics such as Internet Technologies, Connecting Cable TV, Literature, The Modern Presidency, and How to Lead Online Collaborative Projects. In the subsequent 12 months (9/98 through 8/99), a total of 731 participants (368 unique people) attended 85 topical ASO sessions (137 participants were guests). Many more attended ASO sessions that were new-member orientations (not included in above counts). We are pleased not only that we have attracted a wide variety of participants (not the same small core of people), but also that a significant number of participants have found enough value in the sessions to return for other sessions. As one session leader summarized his ASO experience: "I may not get that big an audience for my *After School Online* talks but I have had some of the greatest conversations anywhere with the folks who do show up!"

We are also encouraged by the desire of education organizations to hold their own on-line events in TI. Having attempted to host their own chat rooms in the past, many groups now recognize the value of (a) our support services and (b) introducing their teacher affiliates to a community in which they can become a regular participant after the event. The following e-mail announcement illustrates how an education organization blends asynchronous discussions on its own site with ASO sessions in TI:

> You are invited to attend a FREE Online Event on: "Using Learning Styles to Improve Student Success", October 12-14 1999, sponsored by the Distance Learning Resource Network (DLRN). Participants will have a chance to identify their students' preferred learning styles (as well as their own), and to discuss how integrating preferred modes of learning into their existing classes can improve the student learning experience.
>
> Dr. Carla Lane, who has many years of experience in distance learning and applying learning styles, will moderate. Participants will ask questions, share comments, read background materials, and participate in both message forums (asynchronous) and a real time (synchronous) break out session. This is an ideal opportunity for both teachers and distance learning instructors interested in learning styles, multiple intelligences, assessment, and media selection.

> Event Logistics:
> Most activities will happen in the Online DLRN Interactive Learning Environment October 12-14. In addition, the real-time session will be part of the Tapped In's Community "After School Online" on Wednesday October 13 from 4.00-5.30 PM Pacific Time, or 7.00-8.30 P.M.Eastern Time.

The following e-mail to our Contact Us e-mail help line illustrates the reciprocal value such events have for the TI community. The sender indicates that he is going to introduce his class to TI. It is likely that some members of the class will become TI members:

> I teach models of education and just beginning to relate to on-line learning. I hold a class Wednesday from 4PM to 7PM Colorado time. I would like to get familiar with your site and sign on ASAP before my class tomorrow. So we as a group can see the event" discovering learning styles" and interact with others, I will facillitate my group. I asked for a password today & this is my first experience with your organization.

Free private offices. Most teachers do not have offices in real life. Early on, we thought that having their own on-line *place* might motivate some teachers to experiment with on-line activities. We decided to offer free bare-bones offices (a room and a whiteboard) to any member who wanted one. We began with 72 offices on the third floor and have over time added 14 new floors. Offices have become one of our most popular features (even though we conjecture that most members rarely use their office). More than 600 of our 1,080 offices are now occupied by individual members or small groups. One preservice teacher discovered that if she kept her bookmarks in her TI office, they would always be available no matter where she logged in (a computer at home, one at a university, and another at her internship school). Other offices serve as a clubhouse for small groups of education professionals looking for an on-line venue to hold group meetings. Such groups rarely have the resources or expertise to set up an on-line collaboration environment of their own. However, they do often have innovative ideas and highly motivated members. We have developed formal partnerships with nine organizations that started out experimenting in TI with a single office.

Newsletters and mailing lists. Membership in TI can be thought of as similar to belonging to a professional society. Many of us belong to professional societies (e.g., ACM, IEEE, AERA) that we rarely if ever participate in actively, but we feel that we derive benefit from the association even if we only attend a conference or read the organization's periodical on occasion. In TI, we do not expect all members to log in all the time. Many log in regularly for a month or two and go dormant for months, only to surface again when a need or interesting event arises. To keep both active and inactive members connected to the community, we have established an electronic newsletter called *On the Tapis* (an old English phrase meaning *under consideration*) and a calendar of events that go out to all members monthly. Our intent is that when members read about an activity, new tenant, or new feature that interests them they will be motivated to check it out. The following e-mail illustrates how the calendar mailing and ASO sessions go hand in hand to encourage member participation:

> I would like to request a transcript of the Web Quests After School Online session with Bernie Dodge, scheduled to be held this Wed. pm. Sept.22. I'm going to try to attend the session online, but just in case I don't make the whole thing, a transcript of the meeting would be super. Thanks very much!

Many members (we estimate 30% to 40%) have not logged in past their first visit, and that is all right with us. Some log in after many months away; others never log in again but promote the community in other ways. The following email is from a project director wanting to publicize his project to teachers. He was told about TI by a colleague who had been in TI only once during a training session over 18 months ago. She had been receiving our monthly newsletter, *On the Tapis*, ever since:

> Hello TappedIn! I am wondering if you can post this announcement ON THE TAPIS. One of your members, [SETI staff], referred me to your web-site. We are looking for high school science teachers in the San Francicso Bay Area to pilot test the SETI Institute's Voyages Through Time curriculum. For more info on this, please visit us at www.seti.org/education. and if you can post the following for us, many many thanks in advance. Contact me if any questions -- [E-mail announcement to be forwarded follows]

The *MeetMe@tappedin.sri.com* mailing list is a simple (low-tech) way for our members to find others with shared interests or needed expertise. The mailing list is described as follows on the Web site: "Post ideas you have for collaborative projects, tell the community a bit more about yourself, and set up meetings directly with your colleagues in TI through this list." Every e-mail sent to the list is archived on the Web site (http://www.tappedin.sri.com/info/lists.html). New members can choose to subscribe to this list when they fill out the membership form. Approximately 250 members currently subscribe to the list. Since *MeetMe* was established in March 1998 through September 1999, 211 postings have been sent through the list by 63 different members. This volume of e-mail traffic may seem low for a communitywide resource. However, rather than using the list as a public forum (thereby *spamming* uninterested subscribers), members respond to one another privately via e-mail and telephone. The following e-mails are typical of the feedback we receive.

> Just wanted you to know that I have receive half dozen or so responses to my inquiry about creating a web site! They have all been good suggestions, and most included links I can use or learn from! Thanks for your help!
>
> ---
>
> Received some wonderful responses about my question on improving our inschool suspension. My post to this list was very fruitful. It resulted in a number of emails and three long distant phone calls. Many thanks.

University classes and teacher workshops. Over a year ago, we began to notice groups of approximately 10 to 20 guests logging into TI at the same time. We began to inquire into the nature of the groups and found that they were most often university classes (graduate and undergraduate) studying education technology or inservice workshops designed to introduce teachers to the Internet. Over time, TI has become a regular Web-stop for classes and workshops all across the country (and some foreign

countries). During the June-July 1999 summer workshop season, tour groups logged in almost daily. Sometimes, the instructor or leader would log in days or weeks prior to the session (or e-mail us) to ask whether the group could come in; we typically offer to give them a tour. The email below illustrates both how university faculty recommend TI to their students and how a long-dormant member becomes active:

> I signed on to Tappedin a year or more ago; I have recommended that my graduate students (preparing to be school principals) sign on and use the site; however, other than receive the newsletter I have not yet used Tappedin. I tried to sign on today because I am interested in the topics for tomorrow evening and Tuesday, October 19, and would like to sign on for these sessions. Perhaps I have forgotten my password (If I selected it, I know what it would be; if you assigned one to me, I do not remember it). Please let me know what I should do to sign on and whether I can do this in time to sign on for the session tomorrow evening. I am interested in trying to set up a session for my technology class to meet and try the on-line discussion. I need to know how to go about doing this. Thanks. I do enjoy your newsletter. I have just not taken time to get familiar with the use of Tappedin. I think the idea is great.

We sent her the information she needed and, by coincidence, she logged in today and conversed with one of the authors of this paper. Many faculty return with new students each semester, and some have begun to incorporate TI visits in their class assignments. In the words of one professor, the sessions are "really eye-opening for them to see what was out there. The introduction to TI was a nice way to show them the type of support for teachers that they can expect to see in the future."

Hosting university classes and drop-in groups has helped us grasp the need to support teachers' growth from preservice teacher education and initial certification through master's and Ph.D. programs for veteran teachers. TI has become a place where educators can be both professional colleagues *and* students of their profession. One relationship that formed this way has blossomed into a formal alliance between TI and Pepperdine University's Graduate School of Education and Psychology, which runs masters and doctoral programs that combine face-to-face and on-line courses. Pepperdine faculty and graduate students from around the country use TI daily to hold on-line study groups, seminars, and faculty office hours.

Why On-line Education Communities Fail

We have demonstrated through TI that it is possible for a dedicated group of people to grow an education professional CoP of thousands of members by aggregating large education organizations and small groups, providing simple collaboration tools and continuous support, and hosting activities that foster relationship-building. Despite our progress, we are not yet ready to claim success. To serve as an effective, sustainable catalyst for teacher learning, collaboration, and innovation, an on-line CoP must be given the time and resources to mature, develop social norms, grow leaders, and assimilate into the dominant local culture. At 3 years old, we consider TI to be approaching adolescence as a CoP—showing strong signs of maturity, but still forming its own identity and not quite ready to sustain itself. As a nationwide testbed, TI has had to develop its own culture rather than any local culture. However, we are

confident that our vision of a scalable, self-sustaining community of education professionals—a place in which new ideas germinate, new methods and tools are developed, novice educators can learn about the profession, and journeymen can become valued resources—is achievable within a regional context, as well.

To help ensure the continued evolution of TI and inform the development of local education CoPs, we believe it is important to understand why on-line education CoPs fail to sustain themselves or scale up to reach all who might benefit from them. Virtually all TPD and systemic reform projects now employ Internet tools (e-mail, listservs, discussion boards, Web sites) to support their teachers. A handful of projects have been successful in establishing large-scale on-line education CoPs over several years. Some focus on a specific content area (notably the National Writing Project, Math Forum, and Access Excellence); others are geographically centered (Texas Education Network, Common Knowledge: Pittsburgh, Canada's SchoolNet, Denmark's SkoleKom). Unfortunately, most attempts have fallen short of needs and expectations, despite adequate funding, dedicated and enthusiastic staff, and advanced technology.

The reasons why some efforts succeed while others fail are complex and varied. A formal comparative analysis of the factors that contribute to the success or failure of large-scale on-line teacher communities would provide much-needed guidelines for the development of future on-line education CoPs. Here, we begin to help shape such an analysis by drawing on our understanding of the CoP literature and our own experience. For example, we and others have argued that traditional Internet tools are not designed to support the ebb and flow of discourse and collaboration that is characteristic of professional practice (Hardin & Ziebarth, 1996; Schlager & Schank, 1997; Cothrel & Williams, 1999; Murray, 1999). It is not that Web sites or discussion boards are inappropriate or unnecessary; they are simply insufficient to achieve the desired objectives of ongoing professional discourse—a listserv or newsgroup, no matter how well-trafficked, is not a community of practice.

TI, too, suffers from technological gaps and limitations, and we are working hard to integrate new capabilities into the environment (see Schank, Fenton, Schlager, & Fusco, in press). However, we believe that lack of an appropriate technological infrastructure is only part of the problem. The more severe problems stem from a lack of understanding of how to employ on-line technology to achieve TPD goals and cultivate CoPs. We conjecture that misconceptions concerning the nature of on-line CoPs, how to cultivate them, and the role they can play in reform efforts have contributed to the disappointing outcomes.

One misconception is that layering on-line communication technology over a TPD organization's existing way of doing business (e.g., summer institutes or weekend workshops) will result in an on-line community that will support teachers back in the classroom. In many cases, project staff, who themselves have little experience planning or leading on-line activities, conduct an initial training and then wait to see whether teachers will use the technology before committing the time and resources needed to provide appropriate on-line activities, incentives, and support for teachers. Seeing no benefit to the technology *add-on*, the teachers are not motivated to use it; both staff and teachers feel overburdened by the technology, thereby reinforcing a negative perception of technology as a teaching and learning tool (Schlager et al., 1998). To

effectively leverage the power of on-line communication technologies, TPD staff must take the time to learn to conduct meaningful on-line activities and must provide incentives and tangible rewards for participation. Traditional TPD programs must be redesigned from the ground up (including organizational structure, budgets, and staffing) to integrate classroom-based on-line activities over extended periods of time.

We have heard several TPD project leaders who have tried to integrate on-line activities into their programs lament that they spend too much time and funding to train their staff and teachers to use on-line technology with little benefit. They have fallen prey to a second misconception: the belief that TPD projects can simultaneously build an on-line community and provide content, training, and support through it. Corporations have learned the hard lesson that the adoption of new technologies is often "accompanied by an initial decrease in productivity, with benefits accruing only after the technology in question has been effectively assimilated, a process that often involves the introduction of significant structural changes within the adopting organization" (PCAST, 1997). Our own discourse study (described above) showed that both teachers and TPD providers must understand, and be proficient with, on-line technology *before* they can engage in productive activities on-line. We have found that both teachers and TPD staff can quickly learn to plan and engage in on-line activities through peripheral participation in the activities of other, more experienced members of a CoP. But if the project is new, where do the *more experienced* members come from? The answer must be: from outside the project in an already existing CoP.

Many TPD projects view an on-line CoP primarily as an outcome or by-product of their own efforts, rather than as a larger entity in which their efforts can take root, bloom, and propagate. This *project-centric* view of CoP (the project *is* the community) lacks (and in many cases conflicts with) essential elements stressed in both the CoP and education reform literatures. Over a career, teachers today are likely to participate in a succession of project-based communities with no connection or continuity among them. TPD organizations rarely work together or learn from one another. In many cases, an on-line community is established through insular, highly structured, top-down activities. Missing are the informal back channels of communication, information sharing, and trust building that are central to cooperation and the spread of innovation within a CoP. The resources, incentives, professional and social normative structures, and capacity to sustain and expand innovations throughout the education system must be in place *prior* to the infusion of reform practices (Elmore, 1996; Corcoran et al., 1998). Otherwise, even TPD reform projects that have been successful locally will be unable to sustain momentum beyond the outside funding or scale up to meet regional or statewide needs. This is the role of an on-line education CoP that exists outside of traditional institutional or project boundaries.

Toward *Systemic* On-line Education CoPs

If individual projects should not build their own insular on-line community, then who should build it? Research on systemic education reform strategies that drive TPD (e.g., McDiarmid, David, Kannapel, Corcoran, & Coe, 1997; Lieberman & McLaughlin, 1999; Corcoran & Fuhrman, 1999) suggests to us that building the capacity to leverage the combined power of (a) policy initiatives now driving reform in many states, (b) school-based teacher networks, and (c) innovative content-based TPD projects requires

building both human and technological infrastructures systemwide to support sharing of information, communication, and collaboration across multiple stakeholder groups (e.g., policy-makers, TPD providers, and local teacher collaboratives)—in essence, a *systemic* education CoP.

One function of a systemic on-line education CoP would be to build the capacity of, and provide incentives for, teachers to participate in a variety of teacher education, staff development, and self-motivated professional activities from their workplace via the Internet. A common on-line CoP infrastructure would enable teachers to become proficient with the tools and social norms that they will use in TPD activities through *informal* networking with colleagues, thereby reducing the burden on TPD providers, increasing participation, and allowing providers to focus on their core competencies.

A second role of a systemic CoP would be to build the capacity of TPD providers to offer via the Internet the kinds of TPD experiences that reflect research-based TPD strategies. Each provider should not have to learn by trial and error how to implement innovative TPD programs cost-effectively. TPD projects must be designed and implemented within the context of an established CoP that enables innovation to spread through cooperation and division of labor among stakeholder groups and approaches. Cooperation among organizations within a CoP can enable organizations to avoid redundancy, identify and fill gaps in local TPD services, and focus on developing their core competencies to improve the quality of their TPD products and services. Large grant-funded university programs, local teacher education programs, teacher organizations, and private providers must all work together to support teachers over the years it takes to gain proficiency with new content, tools, and pedagogy. District support staff and local master teachers must be provided with the means to identify and call in outside expertise to assist them when needed.

Finally, a systemic CoP would enable state education agencies to take on the role of organizer and host of an on-line CoP gathering place, planning and conducting regular activities that are of general interest to the community and providing support services (much like a public utility) to the CoP. As Lieberman (1996) points out, "Network leaders try to create *public spaces* where educators can work together across classrooms, schools, or districts. In locations free of the normal boundaries and cultural constraints of one's own organization position or place, it becomes possible to grow a culture of commitment to a new set of ideas and ideals. Helping to build a culture through activities that keep these ideas visible and integral to the work is an important part of leadership" (pp. 53–54). Through informal on-line activities and support services, policy-makers can develop and obtain feedback on new initiatives, build a professional culture, motivate the use of reformed practice, and gain public understanding of and support for reform (Corcoran & Fuhrman, 1999).

If, as we have argued, the concept of a community of practice is central to effective teacher professional development, the capacity of a state education system to establish and maintain a well-functioning on-line CoP that represents all TPD stakeholder groups is as important to the sustainability and scalability of systemic reform efforts as the political, pedagogical, and organizational factors on which traditional TPD research has focused. The next research challenge on the horizon for our project is understanding how the TAPPED IN CoP model can be adapted to meet the needs of education reform

at a systemic level. Recognizing that technology is only a small piece of a very complex puzzle, we want to apply what we have learned to help state education agencies build the capacity to sustain the momentum of systemic reform projects and scale them up to reach all teachers in their states.

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Send Comments to: Mark Schlager schlager@unix.sri.com

Figure 1. TAPPED IN Membership Growth, August 1997 to September 1999

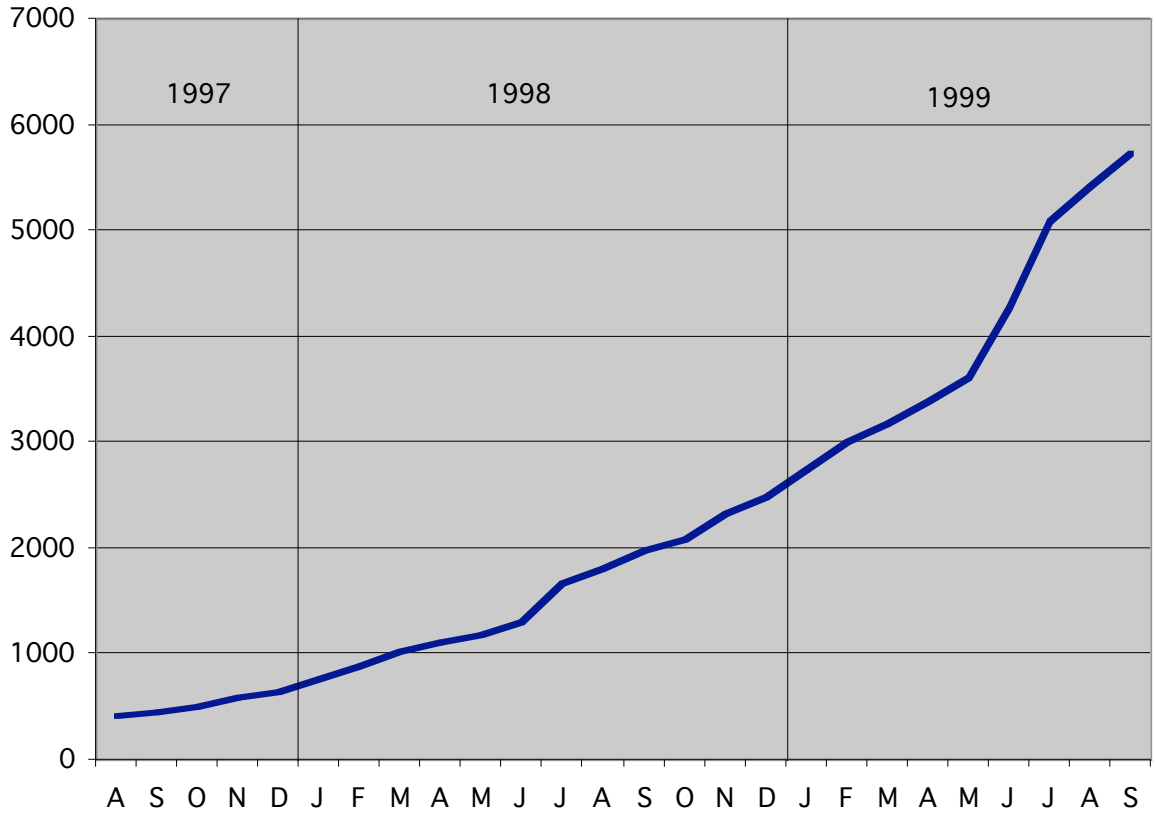

Figure 2. Monthly log-ins and log-in time

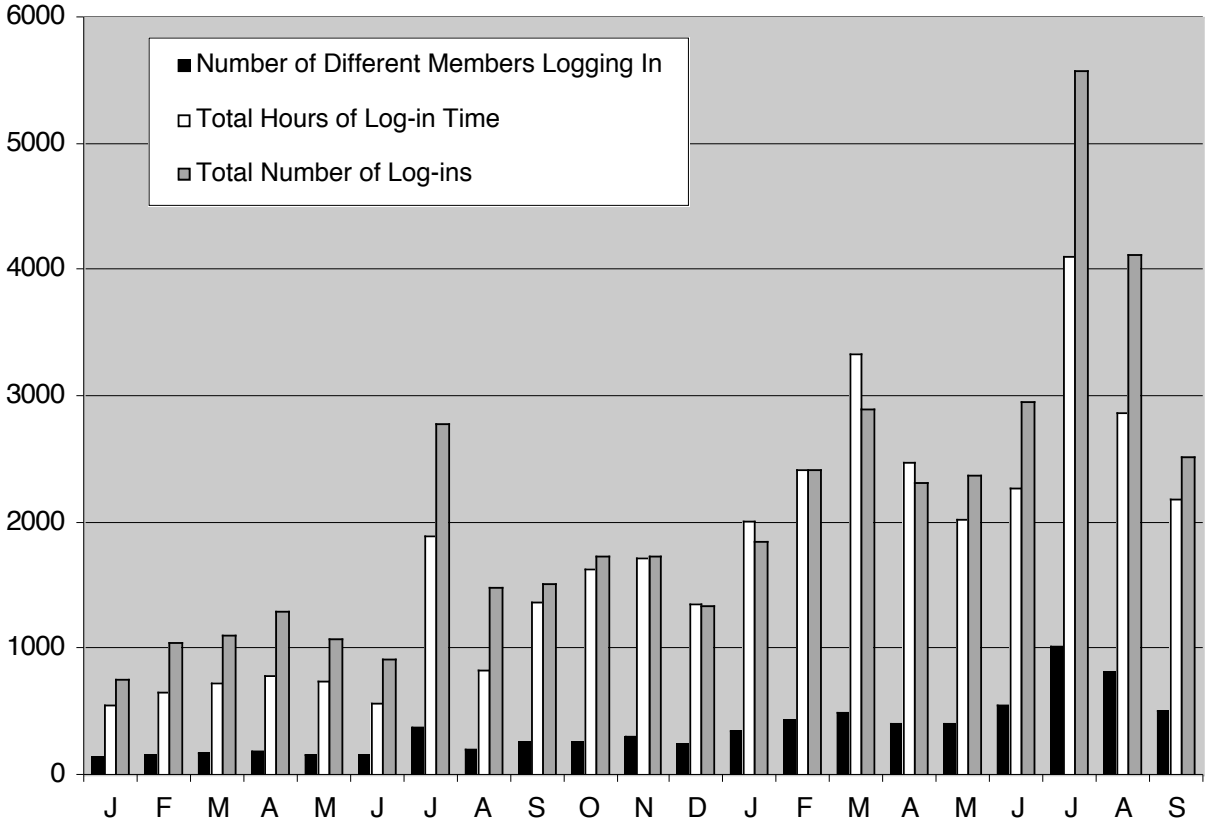

Figure 3. TAPPED IN membership by occupation, September 1999 (n=5689)

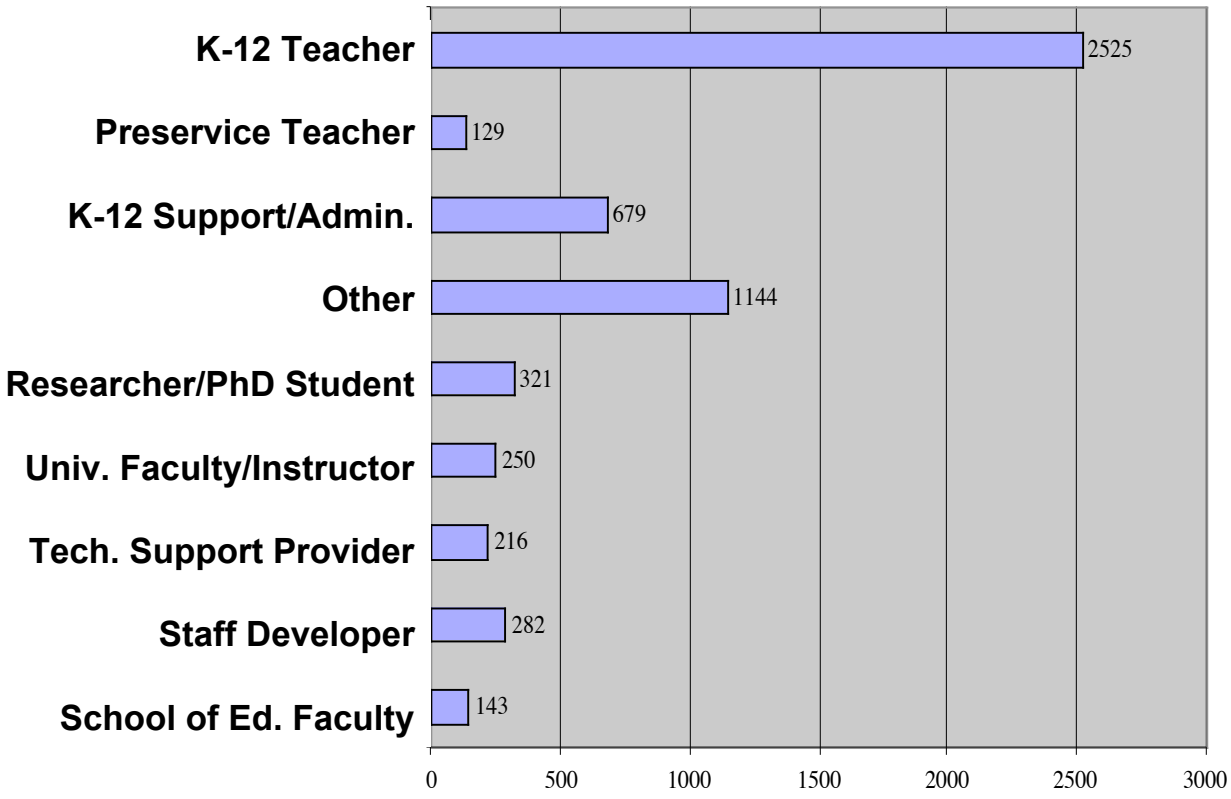

Figure 4. TPD meeting leader dialogue, by category of discourse

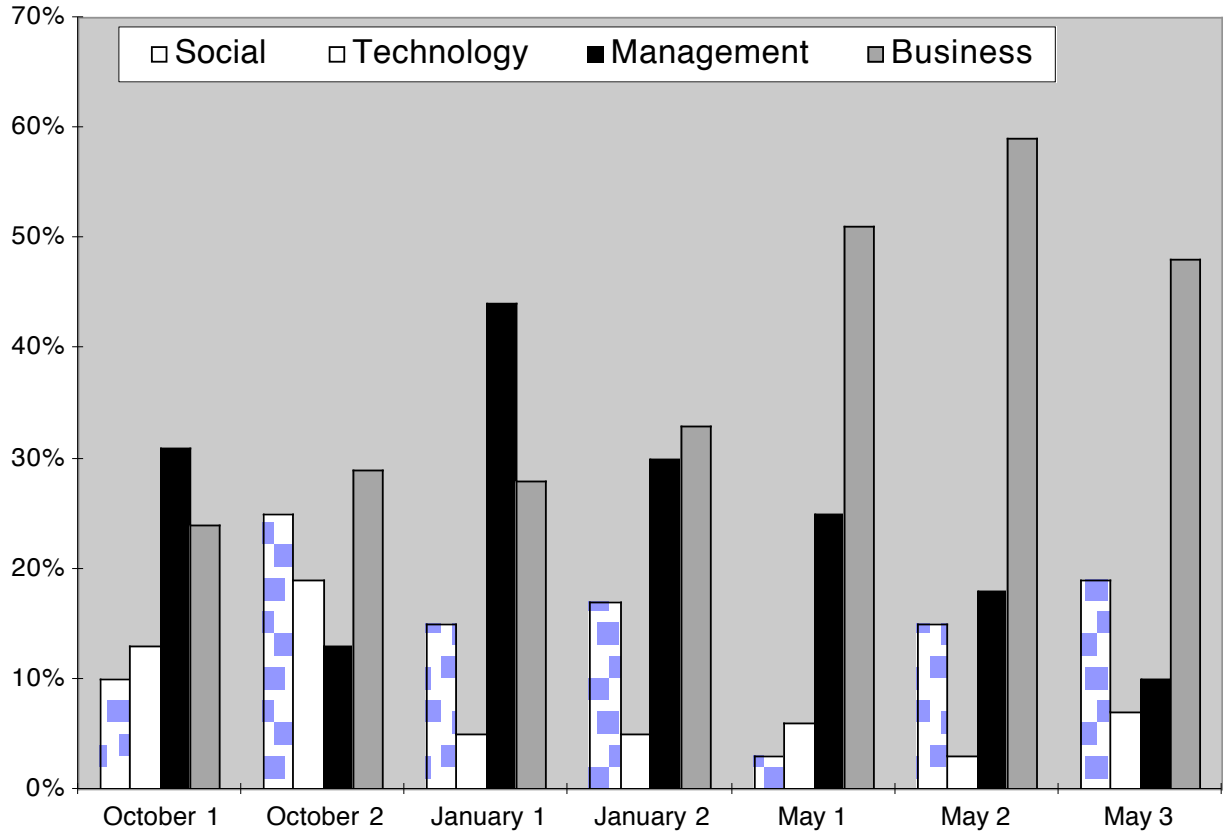

Figure 5. TPD meeting participant dialogue, by category of discourse