"Building an Airplane in the Air": The Life of the Inquiry Group

Bertram C. Bruce
Graduate School of Library and Information Science
University of Illinois at Urbana-Champaign
Champaign, IL 61820
chip@uiuc.edu

To appear in B. Drayton & J. Falk (eds.), *Creating and facilitating effective on-line professional development for educators.* New York: Teachers College Press.

This chapter tells the story of the *Inquiry Group*, which has supported professional development through both online and offline means, thriving for more than 25 years. Many other projects have been designed to foster online, professional development communities, but the story of the *Inquiry Group* looks quite different. We explore here the nature of the group, the reasons for the differences, and the implications for how to study online community building.

The question, "How can professional development be supported through an online community?" has assumed increasing importance because of growing needs and promising possibilities to address those needs. On one side, the demands on lifelong learning have increased in response to changing technologies, demographics, and workplace demands. On the other side, the tools to support online communities have become more both more robust and more accessible, making possible continuing support even among dispersed communities.

Recognition of this situation has led to the organizing themes for this book: How can professional development be supported through an online community? What is the nature of the professional development? What is the nature of the community? What values shaped the online tools? What was the "behind the scenes" facilitation? What was the nature of the online and offline interactions?

These questions are all legitimate and significant. However, they apply best to a top-down model for development, in which tools are developed, community participation is solicited, and developers facilitate community actions. As important as it may be, this model is only one way in which online communities come into being. This chapter tells the story of another approach, one that turns some of those quite reasonable questions inside out.

Models for Development of Online Communities

> The reason that simultaneous top-down/bottom-up strategies are essential is that dynamically complex societies are always full of surprises. Only the negotiated capacity and strengths of the center and the locals, in combination, are capable of pushing for improvement while retaining the capacity to learn from new patterns, whether anticipated or not. (Fullan, 1994, p. 24)

There are many ways that online communities are designed, built, and supported. This book is premised on the need to understand more about the diverse ways that happens. As I seek to describe one community with which I have been involved, I find that the questions described

above are helpful up to a point, but then become perplexing. The problem derives from a set of issues revolving around agency, intentionality, and process. I believe this can best be explained by contrasting two models for development. I should note at the outset that I know of no project that fully accords with either of these; most are a mix of models, with changes over time. Moreover, as Fullan (1994) has shown, hybrid models are often the most effective and long-lasting. Nevertheless, it will be helpful to sketch the two extremes in order to communicate the reasons for my perplexity.

Let's consider first the *top-down model.* This model arises in various ways. In one scenario, researchers, system developers, policy makers, and funders recognize a professional development challenge, e.g., to help teachers learn about new approaches to science education, particularly in situations in which they are geographically dispersed. Following various conferences, workshops, email discussions, planning meetings, and the like, a request for proposals is issued by a foundation or government agency. People in universities and research institutes, who may have had some inkling already about the possible funding, now write proposals to secure funding for specific projects. The proposal defines the professional development goals and the nature of the community to be served or supported. The proposers make initial contacts with potential user communities.

Once a project is awarded, the proposers, who are now *developers* or *facilitators*, proceed to build or adapt online tools, to encourage participation from the target community, and to enter into the cycle of formative evaluation, observing interactions and seeking to improve the tools or community processes. In the course of the project, the values that shaped the online tools, which were articulated in the proposal, are now further refined or even reshaped in the light of experience. Because of complex and changing circumstances, the *developers* find that they are doing many things they hadn't expected to do. This typically results in "behind the scenes" facilitation, and a growing understanding of the complexities of both online and offline interactions.

On the whole, the primary actions are those of the facilitators.[1] Moreover, they establish a beginning point independent of the lived experience of the members of the target community. The project does not come into being until the funding or authorization is secured. It runs a course from there until its completion, when it is evaluated and typically, terminated. In that model, the project is foreground and the community is background.

When a top-down approach enlists participation in the community it can become what Zacklad calls a *community of action*. This description applies to

> dealing with small groups which actively and thus to some extent rationally pursue explicit goals while relying on a tightly woven fabric of relationships to promote mutual sympathy and the mimetic learning that is assumed to characterize primary groups and communities of practice (Zacklad, 2003, p. 193)

Communities of action work towards two kinds of goals simultaneously. The first are *service goals*, which involve transforming an external situation, e.g., designing a new use of technology for learning. The second are *integration goals*, which involve constructing an internal social milieu allowing its members to develop mutual knowledge and identities. These two categories

---

[1] This is not to deny that users may play some role through participatory design and other mechanisms.

of goals reflect the fact that community is a necessary means for transformation of the situation, but as a part of that situation, it, too, is transformed.

As an alternative, we need to consider more bottom-up models.[2] Here, the community is foreground and various projects may or may not contribute to the background. The community exists, grows, faces difficulties, and otherwise lives, independent of a particular funding cycle. Actions such as "specify need" or "identify population," may still be carried out, but they have at most a descriptive, a posteriori function, not a performative, a priori one. When we then talk about behind-the-scenes facilitation, we see that it is done as much by community members themselves as it is by funded developers. Rather than considering one project with well-defined beginning, end, purpose, and audience, we need to consider the story of the community and the way it appropriates various tools, environments, projects, and professional facilitators, along with its other activities. Thus, in the bottom-up approaches, both agency and intentionality shift from the "expert" to the "client."

A bottom-up approach reflects a *community of practice* (Lave & Wenger, 1991) with less explicit goals for either service or integration. Rather than principled design, the process appears more akin to "building an airplane in the air." As a result, questions about when it begins or ends, and whether it reaches its goals make less sense. A revised set of questions then arises:

a) What is the nature of the professional development various community members seek?

b) How does the community evolve?

c) How do the values of community members shape their creation or adaptation of on-line tools and environments?

d) How do community members facilitate content-sharing, reflective discourse, and other kinds of exchanges?

e) How do they engage in both online and offline interactions?

f) How do community members evaluate their activities?

I say that the questions are turned inside out, because they flip who is doing what with or to whom. That flipping is integral to the definition of inquiry within the community and to the significance of online communities for professional development. In order to answer these questions, we need to understand more about the story of the *Inquiry Group.*

The Story of the Inquiry Group

The *Inquiry Group* is a term I use for an assemblage of people, organizations, projects, and technologies, united by common participation, values, and experiences. It is unlikely that anyone would say that they joined or left it on a particular date, or even that they knew for sure the extent to which they belonged. Nevertheless, there are threads that tie together this community over 25+ years.

---

[2] It is difficult to come up with a neutral term to highlight a kind of distributed, situation-specific development with less organized planning. I considered Linear/Branching; Waterfall/Sashimi (terms from software design); Standard/Non-standard; Standard/Organic. The chapter by Joni Falk analyzes these ideas further.

From the various *Inquiry Group* activities, we could identify a particular online community project for consideration. However, the way that the various projects arose, how they developed, who did what, and what they meant for the community would be obscured if one were considered in isolation. Instead, a chronological account should be more informative. It is less important to remember the resulting variety of projects and activities than the picture of how the group continues to *appropriate* and *re-appropriate* online environments to serve its needs (Eglash, Croissant, Di Chiro, & Fouché, 2004).

Dialogues in Methods of Education, 1981-present

If pressed to identify a beginning point for the *Inquiry Group*, we might look to the *Dialogues in Methods of Education (DIME)* group (Bruce & Easley, 2000). This group formed in 1981 for discussion about problems in education, especially in math and science. The members included mostly classroom teachers, but also administrators, scientists, educational researchers, and parents.

In the mid-1980's DIME members began to use *Free Educational Mail (FrEdMail)*, an Apple II email application. Al Rogers, a teacher, had created it for other teachers. In 1985, Al also set up the first *FrEdMail network.* The program did not require any special technical skills to operate, which was appropriate since the primary users were classroom teachers. People in DIME used it for their own communication, but also implemented *Science Network News* within it. This was a means for elementary-school students to ask questions of university scientists. Unlike some similar-sounding systems of today, it saw the children as full participants in the process of investigating scientific questions, and sought to show the commonality between ordinary and expert thinking.

Research in schools by DIME members had found that the top-down model in which experts identify goals, articulate methods, and then work to inculcate those goals and methods simply doesn't work, unless one has quite limited aspirations for inquiry:

> Early in this research they [DIME members] learned that when experts demonstrated their best methods in the teachers' own classes, they relied on backgrounds of mathematical ideas and a confidence with mathematical dialogue that the teachers did not share. Thus, teachers were often unable to emulate these innovative teaching methods. Moreover, the teachers were not learning how to learn as teachers. Demonstration and imitation was not an effective way to foster learning to teach. (Bruce & Easley, 2000)

DIME members met weekly in the first year, but later less often. They continue to meet twice a year, drawing participants from several states.

Inquiry in Teaching and Learning Lunch, 1995-

While DIME continued to meet, some of its members began the *Inquiry in Teaching and Learning Lunch*, a university-based activity. Linda Duke was concerned with thinking, and communicating through art. She asked, and prompted others to ask questions such as “What does art have to do with everyday life?” “With how we learn and grow?” “How does thinking about meaning in art relate to other kinds of thinking--in science, literature, or relationships with others?" Linda was then education director at an art museum. She was involved with a program to promote visual thinking strategies, a creation of cognitive psychologist Abigail Housen and museum educator Philip Yenawine (1993). Linda wanted to share her work as well as to learn

from others. In particular, she knew of work by Margery Osborne and others in science education on the relations between art and science. Others in the local community had a similar need to find places for dialogue about fundamental questions of thinking and learning, which often did not fit well within conventional course work or organizational practices.

Responding to these needs, these members of the group decided to start a brownbag lunch series. About 30 people attended an initial meeting and set up the following schedule for the first few meetings of the *Inquiry Lunch*: City planning as a theme for science learning, learning about the human body/bioengineering, the *Visual Learning Initiative*, gender and mathematics, a summer science program (Grow in Science), and distance learning. As this list indicates, topics varied; often there was no topic set ahead of time at all. People came from diverse departments on campus, as well as from schools and museums. The glue was a shared interest in inquiry, and a belief that the definition of inquiry would best grow out of shared activity and dialogue.

It must be emphasized that the *Inquiry Lunch* was no idyll of inquiry, with delightful discussions spiraling ever onward and upward. Instead, there were inevitable conflicts, debates about content and format, confusions, missed meetings, people who came for a while then dropped out--all the usual problems one might find. Over the years, there may even have been more such problems due to the lack of a tradition, a rigid hierarchy, any extrinsic incentives, explicit objectives, or a designated coordinator. But participants nevertheless found value in the dialogues, creating and growing through the interactions. In contrast to what occurs in many projects that appear similar, the definition of inquiry, the goals, and the measures of success were created by the participants. About the only framing was in an initial invitation message, which said:

> Although the specific topics will evolve on the basis of the interests of the participants, we expect that there will be a focus on promoting inquiry-centered learning, as well as on studying the processes of teaching and learning in classrooms, museums, summer programs, and other settings. Some of the terms that may emerge are "discourse", "practices", "child-centered", "constructivism", "integrated curriculum", "whole language", "project-based learning", and "minds-on" …we're trying to provide a space for dialogue about more divergent and student-centered kinds of teaching and learning. (Email, February 14, 1995)

This meant that the *Inquiry Lunch* was an aberration in terms of the top-down model for professional development. That model expects that a project, even one designed to promote inquiry-based learning, must define its terms and present clear goals, all leading to measurable objectives and evaluation criteria. Moreover, the means for achieving those objectives must be clearly spelled out in terms of key personnel, timelines, materials, and activities. We see those expectations manifested in requests for proposals and in handy guidelines for "organizing your project."

There is much justification for that approach in a competitive environment with limited resources, i.e., in the world we all inhabit. But doing so inevitably entails costs as well as benefits. In this context, one fundamental cost is a reduced conception of the very inquiry-based learning that the project seeks to support. In other words, the more the project specifies its objectives, methods, and evaluation, the more it denies possibilities of inquiry to the participants.

Participants in the *Inquiry Lunch* were often involved in well-structured projects, or in

formal teaching. In those settings they tended to follow the dominant paradigm or to suffer the consequences. But in the *Inquiry Lunch*, they were freer to ask questions that challenged that dominant model for project design. They could more easily explore a phenomenon such as the *strawberry milkshake machine* (Brown, Beck, Frazier, & Rath, 1996).

In a summer science camp, there was an activity involving water and tubes, ostensibly to help children investigate siphons, and more fundamentally, water pressure. In response to the teacher's open-ended invitation to make the "water work for you," two fifth-grade girls decided to construct a (fantasy) strawberry milkshake machine. Below is an excerpt from their dialogue and interaction:

> Mary: All we do is pour a little bit more strawberry in it [Sue gets a small plastic cup from the back table and asks Mary to "put it in here"], and a little bit of ice cream, and then [Sue puts the cup she had gotten down right next to the large plastic cup, apparently to give Mary another chance to put the shake in there], done. Shake it up [tries covering the large plastic cup with the small plastic cup Sue had gotten and seems to think it's too small, so she empties out another large plastic cup holding pencils and rulers and uses it inverted as a top for shaking], and give it to the window [hands the shake toward the imaginary window to the left of the screen].

A typical evaluation of a science program might identify the strawberry milkshake machine episode as being off-task, probably suggesting remedies such as stronger scaffolding for learning. Somewhat more expansively, David Brown (2000), the lead investigator, described this as a "fantasy context of engagement which provided an overall stability within which other modes of engagement (particularly engineering and performance) made frequent appearances." But even that account implies that the value of the activity lies outside itself, that it's OK to make strawberry milkshake machines because that establishes good ways of working together or as Hawkins (1965) argues, necessary "messing about" time.

These ideas were discussed in the *Inquiry Lunch*, but also one felt free to say, "it's great to see children having fun," without the nagging feeling that the fun must be justified in terms of project objectives. Ironically, that freedom often led us to delve deeper into what inquiry might be, and into fundamental investigations of teaching and learning. It might be said that it manifested Feyerabend's description (1975) of the scientific method as "anything goes." Yet oddly, the very freedom led to a deeper focus; we experienced it as opening up the process of inquiry, to encompass phenomena that never should have been demarcated out of bounds.

The Inquiry Page, 1996-present

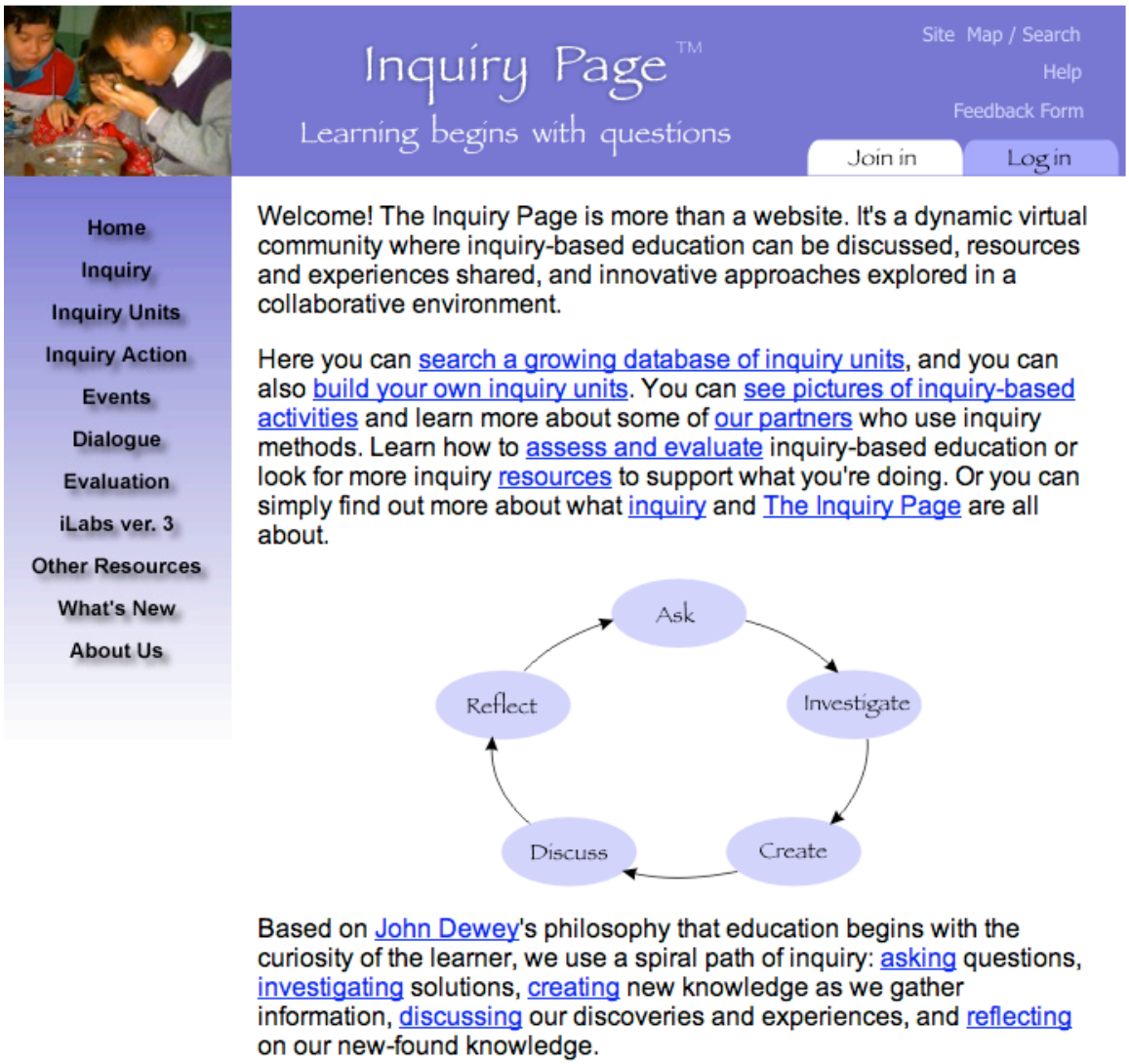
The web was still relatively new as a phenomenon in college classrooms in 1996. But members of the *Inquiry Group* showed how it could be used to continue the dialogues beyond the classroom. In particular, Trudy Morritz and George Reese made a custom-built website to share student course projects. This allowed students to read and comment on each other's work as well as to experience any interactive elements of the projects.

Around 1997, the *Inquiry Cycle* (Ask – Investigate – Create – Discuss – Reflect) emerged from discussions in the group. The cycle draws loosely from Dewey's five-step analysis of effective inquiry in *How We Think* and the natural impulses of a child (inquiry, communication, construction, and expression), as described in *School and Society*. The success of that led over successive iterations of the class into a growing database of what we called *Inquiry Units*. These

units supported investigations into phenomena of all kinds, including into teaching and learning.

Inquiry Units can be created and edited using a web form. The units may have hyperlinks, images, and uploaded files, including videos and spreadsheets. There is a comment feature to encourage dialogue about the units. There is also a *Spin-off* feature that allows a user to customize a unit for another purpose, with the original unit remaining unchanged. There is a link-back path to go from a unit to its parent and to that unit's parent, thus ensuring credit to the original creators and a history of its changes. *Inquiry Units* are a way to represent curriculum elements (from small resources or activities to modules or entire courses). They are also used by students for their learning activities. Thus, they blur the lines between curriculum development and student work, or between teacher and student. Moreover, the increasing use of *Inquiry Units* in project and community settings further serves to position inquiry as an activity that pervades life activity, not simply formal learning. Over the last ten years the *Inquiry Units* have evolved from a simple means for teachers to share curriculum units with other teachers into a general mechanism for people in community centers, libraries, schools, universities, workplaces, and other settings, to engage in collaborative inquiry. Features for co-authorship, comments, spin-offs, document sharing, and group and community support emerged through an open, participatory process of reflective inquiry, not through a centralized design process.

The *Inquiry Page* became a web-based means for people to describe processes of inquiry. It supports a virtual community, where users discuss inquiry-based learning, share resources and experiences, and explore innovative approaches in education within a collaborative environment. On the *Inquiry Page* users can search or add to a growing database of web-based *Inquiry Units.* They can see pictures and descriptions of *Inquiry in Action*. They can learn how to assess and evaluate inquiry-based education or look for more inquiry resources to support their own activities. Or they can simply learn more about inquiry-based learning.



The website is used by teachers, librarians, students, parents, and people involved in a wide variety of community action. University courses and full programs, websites, various research projects, dissertations, and international connections have grown out of the original project. It has spun off other activities, including *Community Inquiry Laboratories* (or iLabs), *Stone Soup* (Robins, 1999, 2002, 2003; Snow, 2005), and Inquiry workshops. Other University staff and students, as well as participants in many parts of the world have played a major role in its ongoing development, and are considered owners and creators as well. In addition, local participants meet weekly to engage in a participatory design process.

We see this inquiry-based approach as especially useful for diverse communities and for linking classroom education with community needs. For example, the East St. Louis Action Research Project sets up community technology centers with recycled computers and internet access for community organizations and churches. Volunteers have used the Inquiry Units to share challenges and solutions to setting up the technology centers, as well as ideas for libraries for teenagers, help for the aged, and economic development. In another setting, African-American women in north Champaign have been working together through Sisternet to take

charge of their own families' health care needs. Sisternet women have created personal health plans, which were facilitated by their use of Inquiry Units. Templates they created became available for other users, as did their model workshops.

Chickscope, 1996-2000

The need for common structures became especially relevant with the Chickscope project. There were primary-, elementary-, middle-, and high school-teachers. In the project, students incubate eggs and raise chickens in the classroom, create magnetic resonance images) of the developing embryos (using web-based remote instrumentation), and learn about incubation and poultry raising, scientific methods, mathematics, embryology, genetics, evolution, biomedical imaging, poultry breeds and economics, research ethics, and diverse other topics in the process.

The common focus on chicken incubation facilitated the development of a community of inquiry. But the diversity of topics meant that no one in that community came close to knowing all there was to know. The *Inquiry Cycle* became a handy way to conceive inquiries we all needed to make into specific topics as well as into the development of learning communities. Continuing meetings in the spirit of the *Inquiry Lunch* became opportunities to learn about inquiry in the broad sense as well as to acquire a deeper understanding of the development of living organisms.

The issue for Chickscope was not how to employ a new technology, such as some new idea for web-based community building, nor was it to design a new system or device, as in conventional participatory design. Rather, it was to focus on problems inherent in practice as defined by participants, such as how one might help middle-school students understand measurement better.

Teachers in the project used the existing *Inquiry Unit* generator to enter their units online. But as they did so, they had ideas about how to improve the interface and how to make the structures more useful for their purposes. The individual and collective effort to address a variety of problems of that sort did in fact lead to online community building and to improved software design, but the value of that software was in how it addressed the initial problems and in how it provided a common focus for the community. In this way, neither means nor ends predominated, but existed in dynamic interrelationship with one another, connected through an inquiry process (Dewey, 1938).

Ethnography of the University, 2002-present

Consistent with an approach to inquiry as both means and ends, the *Inquiry Group* has invited participants to continually examine and re-direct the overall goals, as well as to appropriate tools and resources in new ways. The reflective process, as with other aspects of the project, has been directed by the participants. These ideas are evident in a partner project, the *Ethnography of the University (EOTU)* (Abelmann, Kelleher, & Mortensen, 2005), in which undergraduate students engage in research their own lived experiences. They address issues such as the experience of Korean students in American universities, the transition from high school to university, or violence in American society. As they do this, they create *Inquiry Units* to represent the results of their ethnographies. This use significantly extends what was originally a curriculum development tool.

The ethnography use in turn has led through a participatory design process to major

additions and improvements in the software. Users *appropriate* the technology to meet their own needs. They not only use it for diverse purposes, but as participatory designers, they become active creators, rather than passive recipients of someone else's idea of what the technology should be (Bruce & Rubin, 1993; Eglash, Croissant, Di Chiro, & Fouché, 2004).

EOTU has now created hundreds of *Inquiry Units* in more than 50 courses. The project has invested its own resources to add features to the *Inquiry Page* to better address its needs. These changes in turn have become available to all other users. We view the continuing engagement and use as one measure of success. EOTU now has a forthcoming book featuring the *Inquiry Page*, holds annual student conferences, and functions as a learning group for students, staff, and faculty interested in what it means to conduct research on universities as institutions.

Experiences of EOTU, especially the need for group support, led to extending the *Inquiry Page* to include *Community Inquiry Labs*. These are systems for communities to use to support communication, collaboration, and content management. *Community* emphasizes support for collaborative activity and for creating knowledge that is connected to people's values, history, and lived experiences. *Inquiry* points to support for open-ended, democratic, participatory engagement; and *Laboratory* points to learning that brings theory and action together in an experimental and critical manner. The *Community Inquiry Labs* include *Inquiry Units,* as well as other tools, such as calendars, contact lists, and document centers.

Lessons Learned

> Inquiry is the controlled or directed transformation of an indeterminate situation into one that is so determinate in its constituents distinctions and relations as to convert the elements of the original situation into a unified whole" (Dewey, 1938, p. 108).

The various experiences of the *Inquiry Group* offer a number of lessons about how online or hybrid communities develop and can be supported. This section considers some of these lessons, drawing also from John Dewey's definition of *inquiry* as the process of transforming situations. Dewey's theory provides a useful framework for considering the wide range of goals and activities we see here.

Deweyan Inquiry

There are many ideas packed into Dewey's definition of inquiry. It articulates a process common to the inquiry of a scientist, a teacher, a small child, or a community group. Moreover, this inquiry can be both physical and mental. Thus, putting on a coat to get warm would constitute inquiry. Furthermore, it pertains to a full range of moral, aesthetic, emotional, physical, as well as cognitive dimensions. This is in contrast to Peirce's notion, which separates fact from value and does not construe ordinary actions as inquiry (Talisse, 2002).

An essential aspect of the definition is that it sees inquiry as involving transformation of situations, not simply learning new concepts or acquiring decontextualized skills. Thus, it involves embodied action in the world as much as it does thinking; it means changing the world, including creating the means to enhance further inquiry. There is an underlying assumption of an ever-changing world. The goal is then not to remove all doubt, but rather to continually shape one's own situation in order to achieve greater unity. Dewey's idea is thus akin to biological

homeostasis, in which organisms survive by regulating both their internal systems and their settings in order to adapt to a complex, sometimes hostile, and ever-changing environment.

Individual and Collective Inquiry: Boundary Objects

How can inquiry involve the possibility of learning with and from others, while at the same time addressing individual situations? Participants in the *Inquiry Group* learned several times about a dual nature of standardization. On the one hand, it tends to regularize and thus limit inquiry. On the other, it facilitates communication and thus enables the very collaboration that fosters inquiry. Accordingly, there has been an effort to devise structures that are flexible enough to encourage divergent thinking, yet substantive enough to facilitate dialogue. Such is the definition of *boundary objects* (Star & Griesemer, 1989). It was not a problem that these objects might be interpreted or used differently in diverse settings. In fact, their value lay in being "stable enough to circulate, ambiguous enough to be an object of multiple meanings."

For example, the *Inquiry Cycle* arose initially for the simple reason that it was becoming difficult to manage the posting of multiple *Inquiry Units*. Over time, the cycle itself became a focal point for discussions. It became, for better or worse, a representation of inquiry, and has been widely reproduced in books, articles, and course websites. To this day, there are people who see it as overly constraining, and others who ask for more structure. Moreover, there is a wide variation in the way it is used.

The cycle plays an important role in structuring specific inquiries as well. It helps to turn vague difficulties into specific representations of the problem and possible solution paths. In that sense, it supports what Dewey calls "the controlled or directed transformation of an indeterminate situation...into a unified whole."[3] Specific *Inquiry Units* might then be considered as boundary objects for problem solving or inquiry in particular domains.

Control of the Process: Design as Inquiry

Who does the controlling or directing of inquiry transformations? The process we have experienced through the *Inquiry Page* development is akin to *participatory design*, which "places a premium on the active involvement of workplace practitioners (usually potential or current users of the system) in design and decision-making processes" (Computer Professionals for Social Responsibility, 2005, ¶1). But participatory design is often reduced to a process of obtaining information from users in order that the "actual" designers can make more informed and useable decisions. Users and developers are then seen as two distinct categories, each with special, almost disjoint sets of expertise. Mechanisms are developed (focus groups, surveys, user testing, workplace task analysis, iterative design, etc.) to help users to communicate their knowledge to developers. What we saw with Chickscope was quite different from that conception of participatory design; to highlight the distinction, we have called it *inquiry-based design.*

Under the conception of inquiry-based design, there is no a priori assumption that *any* computer system would be used, designed, or redesigned. Moreover, users and developers are participants in a community of inquiry. In the case of Chickscope, some of the teacher users had

---

[3] I am grateful to Brian Drayton for pointing out how the *Inquiry Cycle* serves this "problematizing" or "intellectualizing" role.

much greater technical know-how, such as for website design, than did the university participants. The university people in turn were often as much teachers and users as those who might be designated as such. We did not see communication among participants as a means to better design. Instead, we saw design, when and if it emerged, as the outcome of collaborative problem solving; a new technology was a fortuitous by-product.

This argues that users should be empowered to participate actively in design, development, implementation, distribution, use, and evaluation of resources, not simply as informants. As Dewey argues, they need to enter into the *process of authority.* Accordingly, the on-line tools and environments here could not be conceived as fixed elements to achieve pre-defined ends, but rather as tools for inquiry, which themselves are transformed through the inquiry process. Through contributions to content, participatory design, and appropriation into new situations, participants are not merely passive recipients, but active creators of the very system that promotes their own inquiry.

Continual Development: Pragmatic Technology

How does inquiry relate to ever-changing situations, including shaping those situations? The process of the *Inquiry Page* development may be described as *pragmatic technology* (Hickman, 1990). Typically, we conceive a technology as a tool to solve a problem, for example, a toaster to toast the bread. We ask then about whether the technology is appropriate or effective for a given task. In the realm of learning technologies we often see a process in which users are taught, cajoled, even paid, to make use of a new technology to solve problems they never realized they had. Alternatively, the problems they do have remain unaddressed and unsolved.

The pragmatic technology perspective steps back from the idea of pushing a particular technology, and instead places inquiry at the center. In that way, it conceives technologies as representing the outcome of problem solving, not the a priori means. In that sense, the idea of holding a piece of bread over a fire is a technology for toasting, just as laying it on a rack in an oven. Viewed this way, technologies become stages in an inquiry process. Each surmounting of a problem becomes a new technology, whether in the form of a procedure or technique, a term, a set of guidelines, or a physical device. That technology in turn provides the means for enlarged or enhanced problem solving in the future. Technologies may thus be seen as the Creation or Reflection aspect of the Inquiry Cycle, taking us to a new, expanded, or deeper Asking.

From the perspective adopted here, the best test is the growth and development of the community, and participants' continued efforts to change it. As Feyerabend argues for progress in science, it is not the lack of falsification, which determines scientific truth, but the continued willingness of participants to modify and extend the theory. The analogue here is that the evolving system itself becomes a measure of the development of the community.

Because participants are encouraged to define their own goals and ways of using the *Inquiry Page*, we need diverse metrics for impact. One general measure is continued engagement, which, we believe reflects participants' judgment that the tools and the project as a whole address their needs. For example, the Sisternet project used the Inquiry Units initially for creating personal "spiritual health plans," meaning a holistic approach to managing health for themselves and their families. This was coupled with workshops in which Sisternet members discussed these plans and provided mutual support. Later, they created "intellectual health plans," "fitness plans," and "financial plans." More than 200 Inquiry Units have thus been

created by individuals or by groups within that community. We record data such as page visits and workshop attendance, but continue to work with community partners to define appropriate measures for their community needs.

Unified Whole: Defining Inquiry

The *National Science Education Standards* (National Research Council, p. 23) defines *scientific inquiry* as "the diverse ways in which scientists study the natural world and propose explanations based on the evidence derived from their work. Scientific inquiry also refers to the activities through which students develop knowledge and understanding of scientific ideas, as well as an understanding of how scientists study the natural world." That definition is typical in that it emphasizes the *ways* or *activities*, which either scientists or students of science use to learn.

It is beyond the scope of this chapter to critique that definition, but it should be noted that this definition is not the only one. It is noteworthy that despite direct or indirect citations to the work of John Dewey, definitions of inquiry most compatible with the *NSES*, may trivialize Dewey's key insights about inquiry as an embodied, participatory, social, moral, and critical process. The very idea of standards developed in isolation from the lived experience of students and teachers, and without their active participation would have been problematic for Dewey.

Within the *Inquiry Group*, a major activity over the years has been to continually refine and extend the understanding of inquiry itself. This is evident in three themes, none of which are unique to the project, nor proposed as universal, but instead developed in forms appropriate to the situations encountered here. They serve to describe the learning of all the participants, regardless of their formal roles as users, developers, students, or teachers.

One theme is that inquiry is inherently *a cross-disciplinary, collaborative, and participatory process*. In this perspective, ownership of the process of development is both a means and an end. Rather than setting out specific objectives for professional development or change, the approach has been to work together to create an environment, which is supportive of the diverse kinds of inquiry in which participants engage. Thus, it is not a case of bringing people into an interactive environment, but rather collaborating with them to build it. Knowledge construction depends upon community processes--sharing and building upon each other's work.

A second core theme is *respect for diversity*, meaning that each individual should be recognized for his or her own abilities, interests, ideas, needs, and cultural identity. Dialogue across differences is not a necessary evil, but the generative force behind change and growth. Every situation is unique; as Dewey argues, there is *no absolute value* in education. Nevertheless, we can all learn from the experiences of others. Our ordinary experiences are fundamental, but it is through reflection on experience and dialogue that individuals are able to grow and prepare for enlarged experiences in the future.

A third theme is that underlying specific community or pedagogical aims is helping all participants develop a *critical, socially-engaged intelligence.* Dewey argues that creation, not acquisition, ought to be the measure of a civilization, and this perspective applies to the individual as well. In other words, acquiring skills or knowledge is of little import if it doesn't enable the individual to contribute to the community, and to the development of those around them.

An example of these themes can be seen in a partner project, Dr. Pedro Albizu Campos High School (PACHS) in Chicago. Their "major goal is to *work with students* [my emphasis] to

focus on their education. Students are encouraged to think critically about their learning experiences and to participate actively in their communities." The curriculum has three goals, which may be glossed as (1) understand the world (develop cognitive skills), (2) learn how to act responsibly in the world (focusing on the development of self-identity and self-worth by analyzing the Puerto Rican and Latino/a realities), and (3) learn how to transform the world.

The PACHS curricular goals align only roughly with the definition emerging from the *Inquiry Group*, because they have grown out of different lived experiences. But the process forward will be to seek to understand the diverse experiences and to bring them into dialogue. Thus, the very definition of inquiry will continue to be seen as a continual process, not as a starting point or end goal to achieve. As Dewey argues, the value is not in completion, but in an enlarged capacity for experiences in the future.

A Community of Practice

Many projects have worthwhile goals, and work humanely and creatively to realize them. These goals might include fostering collaborations among teachers, preservice teachers, and scientists; facilitating scientific investigations using the Internet; enabling the use of new technologies in science classrooms; promoting standards-based curriculum materials; or preparing teachers for incorporating inquiry-based learning and teaching in science and mathematics classrooms. Our schools would be significantly better if those goals were even partially attained.

But there is a fundamental inconsistency inherent in this top-down approach. As Ella Flagg Young argued in her early work in the Chicago schools, one cannot force teachers to teach democracy (Smith, 1979; Tanner, 1997). Nor is it enough to let them teach it. She would ask instead: How can teachers teach democracy if they work in a system in which they have so little say in what they teach and how they teach? How can they then communicate to children what it means to work across differences, to take responsibility for one’s actions, and to participate creatively and actively in the society around them? Thus for Young, and her mentor, John Dewey, the teaching of democracy was inseparable from living democracy.

There is a risk in the top-down model, that a role such as participate-in-the-community becomes separated from those of build-the-community or evaluate-the-project. Building the tools for community can be removed from living in the community; finding tools for inquiry can be apart from inquiring, and that in turn apart from learning about inquiry. As actions are parceled out to participants--developers, evaluators, teachers, students, and so on, the forms of understanding are as well. Thus, one group is to learn about inquiry in the science classroom while another is to learn about design of online communities. This quite natural division of labor has its value of course, but it also sets limits on everyone's inquiry, and on their feelings of ownership and participation.

In an inclusive community of practice, roles exist as well, but they are fluid and open to continual renegotiation. The activities of the *Inquiry Group* show that there is much more room in the process of authority than we often acknowledge. Correspondingly, one major impact has been on the individuals involved (Williamson, 2003), rather than on formal organizational structures. Along with this recognition is the notion that inquiry flowers most when understanding and action come into dynamic and reciprocal relationship with one another. The *Inquiry Group* has developed without a mission statement, major funding, explicit rules,

membership dues or criteria, or institutional standing. Despite, or maybe because of, this openness, various activities have been energizing, often spawning others, and it has continued in various forms for over 25 years, thus demonstrating both sustainability and scalability.

Conclusion

Members of the *Inquiry Group* have sought to understand inquiry-based learning through both formal research and informal dialogue. They use mechanisms such as workshops and social websites to facilitate inquiry. In response to the reasonable question: "What did w*e* do behind the scenes to make it work for *them*?", the *Inquiry Group* changes the pronouns. Instead of *we* as the actor and *them* as the recipient, it sees *we* and *them* as coequal, and their differences as sources of strength, not deficits to overcome. This extends across realms of learning, technology design, teaching methods, and evaluation.

Both the successes and the failures of the *Inquiry Group* derive from an underlying question throughout. That question is a response to the one above, and is an appropriate conclusion to an ongoing process, which we can answer only in part today: What happens when users are not merely recipients of a design for inquiry, or even informants for the design, but instead *become a part of the process of authority throughout*? In other words, what if we imagine development *as* inquiry, not development *for* inquiry?

References

Abelmann, N., Kelleher, Jr., W., & Mortensen, P. (2005, January 21). Ethnography of the University Cross-Campus Initiative. Progress report, University of Illinois at Urbana-Champaign.

Brown, D. E. (2000). *Merging dynamics: An integrating perspective on learning, conceptual change, and teaching, and its implications for educational research.* Paper presented at the annual meeting of the American Educational Research Association,, New Orleans.

Brown, D. E., Beck, D., Frazier, R., & Rath, A. (1996). *Siphons and strawberry milkshake machines: Is fantasy in science inquiry a valuable context or an unwanted distraction?* Paper presented at the annual meeting of the American Educational Research Association, New York.

Bruce, B. C., & Easley, J. A. (2000). Emerging communities of practice: Collaboration and communication in action research. *Educational Action Research, 8*(2), 243-259.

Computer Professionals for Social Responsibility (2005, June 1). Participatory design. Retrieved November 14, 2006, from http://www.cpsr.org/issues/pd/

Dewey, John (1938). *Logic: The theory of inquiry.* New York: Holt Rinehart & Winston.

Eglash, R., Croissant, J., Di Chiro, G., & Fouché, R. (2004). *Appropriating technology: Vernacular science and social power.* Minneapolis: University of Minnesota Press.

Feyerabend, Paul (1975*). Against method.* London: Verso.

Fullan, M. G. (1994, September). Coordinating top-down and bottom-up strategies for educational reform. In R. J. Anson (Ed.), *Systemic reform: Perspectives on personalizing education* (pp. 7-24). Washington, DC: Office of Educational Research and Improvement (ERIC Document Reproduction Service No. ED 376557)

Jones, M. C., Rathi, D., Twidale, M. B. (2006). Wikifying your interface: Facilitating

community-based interface translation. *Proceedings of the ACM Symposium on Designing Interactive Systems.* State College, PA.

Hawkins, D. (1965). Messing about in science. *Science and Children, 2*(5), 5-9.

Hickman, L. A. (1990). *John Dewey's pragmatic technology.* Bloomington: Indiana University Press.

National Research Council (2000). *Inquiry and the national science education standards: A guide for teaching and learning*. Washington, DC: National Academy Press.

Robins, J. (1999). *Stone Soup: A distributed collaboratory using software agents*. [Online: http://faculty.cmsu.edu/jrobins/ss_paper.html]

Robins, J. (2002). StoneSoup: A contextualized portfolio system. *Proceedings of Computer Support for Collaborative Learning: Foundations for a CSCL Community* (p. 538-539). Hillsdale, NJ: Erlbaum.

Robins, J. (2003). *The role of a mediating information structure in a contextualized system.* Ph.D. Thesis, University of Illinois at Urbana-Champaign.

Smith, J. (1979). *Ella Flagg Young: The portrait of a leader*. Ames, IN: Educational Studies.

Snow, J. (2005). *Stonesoup: Technology innovation, introduction, and use to support learner-centered education*. Ph.D. Thesis, University of Illinois at Urbana-Champaign.

Star, S. L., & Griesemer, J. R. (1989). Institutional ecology, 'translations,' and boundary objects: Amateurs and professionals in Berkeley's Museum of Vertebrate Zoology, 1907-1939. *Social Studies of Science, 19*, 387-420.

Talisse, R. (2002, Spring/Summer). Two concepts of inquiry. *Philosophical Writings, 19/20*, 69-82.

Tanner, L. N. (1997). *Dewey's laboratory school: Lessons for today*. New York: Teachers College Press.

Williamson, J. (2003). *Teachers as change mediators in educational reform*. Ph.D. Thesis, University of Illinois at Urbana-Champaign.

Yenawine, Philip (1993). *What Do You See? Videotape on teaching in art galleries.* Chicago: Art Institute, Dept of education.

Zacklad, M. (2003). Communities of action: a cognitive and social approach to the design of CSCW systems. In M. Pendergast, K. Schmidt, C. Simone, M., & Tremaine, M. (Eds.), *Proceedings of the 2003 international ACM SIGGROUP conference on Supporting group work* (pp. 190-197). New York: ACM.