Handbook of Research on Socio-Technical Design and Social Networking Systems

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Chapter XLV
Situated Evaluation of Socio-Technical Systems[1]

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ABSTRACT

This chapter introduces situated evaluation as an approach for evaluating socio-technical innovation and change. Many current evaluations simply identify the impacts of technology and deprecate alternate uses in their analysis. Situated evaluation instead calls for understanding how innovations emerge through use; this entails consideration of diverse uses, the contexts of use, and the reasons for the development of multiple realizations. The chapter presents a comparative study of different classroom uses of electronic Quill in order to demonstrate how this alternative evaluation can be conducted and to address the value of understanding and fostering diverse cultural appropriations of a socio-technical innovation.

What about the lay public as producers of technology and science? From the vernacular engineering of Latino car design to environmental analysis among rural women, groups outside the centers of scientific power persistently defy the notion that they are merely passive recipients of technological products and scientific knowledge. Rather, there are many instances in which they reinvent these products and rethink these knowledge systems, often in ways that embody critique, resistance, or outright revolt.

—Eglash, 2004, p.vii

INTRODUCTION

Implementing an innovation entails making changes to an existing system of social practices. People involved with that system naturally want to know what those changes mean and are, therefore, drawn to calling for some sort of an evaluation. Based on the results of the evaluation, practitioners, policy makers, and administrators make their practical decisions about the fate of the innovation. They often focus on evaluation outcomes alone, but the setting of evaluation questions and methods is as important as the outcomes. Evaluation processes embed evaluators' assumptions about the innovation and its relation to the relevant social contexts.

In this chapter, we raise questions about the basic assumptions and limitations that standard approaches to evaluations have, and introduce *situated evaluation* as an alternative approach that aims to uncover, not the way that an innovation interacts with practice, but rather the very emergence of innovations through practice. Through a study of Quill, an electronic composition system that was developed for teaching writing in the early 1980's, we demonstrate how this alternative evaluation can be conducted. We also discuss the values, challenges, and methodological issues related to using situated evaluation in supporting further understanding of socio-technical innovations. As new digital technologies increasingly pervade aspects of our daily lives, the innovations-in-use issues that arose in Quill implementations are even more relevant today.

QUESTIONING THE NATURE OF STANDARD EVALUATION

Standard evaluation practice tends to emphasize either formative or summative approaches. Formative evaluation is typically done during the development or improvement of a program and is conducted iteratively. Results are often informal and lead to recommendations for change. Summative evaluation provides information on the program's efficacy, such as improvement of student learning. In this chapter, we propose an alternative, which questions the basic assumption of "what" it is that is being evaluated.

In evaluating a new technology, researchers typically consider the innovation as a fixed object created by professional developers. They further assume that its benefits are somewhat fixed and known in advance with respect to social practice. For example, a program might be developed to help students learn a concept in science or to help a community engage in community building through better communication. Evaluation then becomes a way to improve that program or to assess its effectiveness. This is a reasonable approach, one that is fully in line with calls for reflective practice. But in its extreme form, the assumption that what the program actually is known prior to its integration into social practice becomes what Papert (1987) defines as *technocentrism*:

> *Egocentrism for Piaget does not, of course, mean "selfishness"—it means that the child has difficulty understanding anything independently of the self. Technocentrism refers to the tendency to give a similar centrality to a technical object—for example computers or Logo. This tendency shows up in questions like "What is THE effect of THE computer on cognitive development?" or "Does Logo work?"* (p. 23)

The problem here is that a technocentric perspective limits the scope of the evaluation, often making it difficult to see unexpected uses of an innovation. But, as any developer knows, technical innovations often result in unplanned uses and diverse readings of the innovation. Often, the variation in use is greater than the variation in programs, so that the claim to be evaluating a particular program becomes convoluted with discussions about faithfulness of implementation or effectiveness of the program per se versus effectiveness of its introduction.

One good example occurs in the discourse on online collaboration and learning systems. The early visions of new communication and information technologies asserted that their fundamental attributes

could support innovative learning environments that promoted students' active participation, reflective thinking, attainment of self-discipline, and connections with the real world. However, this visionary perspective of educational computer-mediated communication has altered due to the unexpected effects of diverse teaching and learning practices.

For instance, Burniske (2001) designed and implemented several "telecollaborative" projects using e-mail, but eventually reported on the limitations of telecommunication for learning. Burniske's first project, "Project Utopia," used electronic mailing for having his students discuss utopia and dystopia with another colleague's students in a different location. Burniske judged that this project "had inspired a few constructive discussions, but many of them dissipated as students' imaginations, liberated from real-world concerns, took flight" (p. 36). Then he developed another project, "South African Elections' 94 Internet Project," which allowed e-mail exchanges among 11th and 12th grade students in South Africa and the U.S. However, he realized that students' discussions remained shallow and felt it difficult to improve the quality of the discourse. From these experiences, he started questioning the linear impact of new communication technology integration on student learning. Other scholars from critical perspectives have similarly questioned positivist views of technology's effects on practice (Bryson & De Castell, 1998; Bruce, Peyton, & Batson, 1993). These critical views have argued that new technologies do not generate social change, but are instead mutually constituted with social practice.

Standard (summative and formative) approaches have wide-ranging and important uses for evaluating socio-technical systems. But as they are usually carried out, they also have a crucial limitation related to examining the interaction of the technical innovation with the context in which the innovation is used. This makes it difficult to attend to the process of change, and consequently, to many of the concerns people have about innovations.

R. M. Wolf (1990) describes three key problems with standard evaluation. First, most evaluations do not identify the reasons for the observed phenomena. Thus, they do not say how the innovation can be improved, nor what aspect of it produced the measured effects. Second, not being able to account for why changes occur means that it is questionable to generalize to other settings in which the innovation might be used. Third, the development process often continues after the evaluation, so that most evaluations are effectively of innovations that no longer exist. Again, without knowing more about the situation and process or use, one cannot say whether initial results are still valid for the changed innovation.

Many researchers have proposed ways to attend more to the process of change. Some call for an emphasis on formative evaluation. Others call for broadening the range of measurement tools used for summative evaluation (Miles & Huberman, 1984). In *responsive evaluation*, evaluators become sensitive to the interests and values of the variety of participants involved with the innovation (Stake, 1990). Others call for multiple case studies across different settings to identify the variations and differences (Stenhouse, 1990). Each of these approaches makes a contribution to the study of socio-technical innovation and change. But often these methods fail to answer a basic question for a potential user: How can the innovation be re-created in one's own setting? Rather, they still designate which type of use is "acceptable" and which is "unacceptable." This leads us to raise a fundamental issue about the nature of evaluation: What is the "it" being evaluated?

SITUATED EVALUATION

Situated evaluation is an approach to articulating the emergence of innovations through practice, assuming that innovations are mutually constituted by social practice and some external input. It starts with the common finding that a program operates differently in different settings. But rather than postulating that there is one program used in different ways, it asserts that multiple programs

come into being through use. This ontological shift leads to different ways of analyzing, describing, and conceptualizing alternate, or even non-uses. A bibliography of situated evaluation studies can be found online at http://illinois.edu/goto/siteval.

A situated evaluation approach conceives technology users as active creators, rather than as "passive recipients of technological products and scientific knowledge" (Eglash, 2004). Users actively rethink the meaning and use of a technology and reinvent its practices by appropriating them within their situated, cultural contexts. Eglash (2004) calls this process *appropriating technologies*. We would go one step further to say *creating technologies*.

In these situations, we need a new type of evaluation that is open to new variables and sensitive to alternate uses and interpretations. This new concept of evaluation needs to focus on the *innovation-in-use*, and its primary purpose is to understand the different ways in which the innovation is realized and thus created. *Situated evaluation* then emphasizes the unique characteristics of each situation in which the innovation is used. With this approach, the object of interest is not the idealized form in the developer's specs, but rather, the realization through use. The "it" being evaluated is no longer the innovation (or even what we call the *idealization*), but the innovation-in-use, a situation-specific set of social practices. Recognizing the richness and the importance of the realization process also leads us to ask new sorts of questions for evaluation (see Table 1):

- What practices emerge as the innovation is incorporated into different settings?
- How well do the different uses of the innovation work?
- How can different realizations be improved?

KEY ELEMENTS OF SITUATED EVALUATION

Situated evaluation is a process of discovering relationships. Although it does not resolve into a simple, linear procedure, there are three major aspects of this process. First, it looks at the idealization of a technical system or program, in order to delineate as fully as possible what was intended by the developers. Second, it examines the settings in which a technology is used. Third, it analyzes the realization processes in different settings and generated hypotheses about how and why these realizations developed as they did.

The Idealization of the Innovation

We define the elements of the innovation as intended by developers as its *idealization*. An analysis of the idealization is part of a situated evaluation because it serves to characterize how participants in the setting of use might have perceived the innovation. It is also an index of the intentions of the developers, people who are often important participants not only in the initial creation of the innovation, but in its re-creation in context.

In contrast to the priorities for summative evaluation, the innovation is not privileged over any of its realizations; similarity to the idealization does

Table 1. Questions about innovations and change

Old Questions	New Questions
What can the innovation do?	What do people do as they use the innovation?
To what extent are the innovation's goals achieved?	How do social practices change, in whatever direction?
What constitutes proper, or successful, innovation?	What are the various forms of use of the innovation-in-use?
How should people or the context of use change in order to use the innovation most effectively?	How should the innovation be changed and how can people interact differently with it in order to achieve educational goals?
How does the innovation change the people using it?	How does the community fit the innovation into its ongoing history?

not count as more successful, and non-use can be as important to consider as "faithful" use. Moreover, the innovation is not seen as an agent that acts upon the users or the setting, but rather as one more element added to a complex and dynamic system. It would be more correct to say that the users act upon the innovation, shaping it to fit their beliefs, values, goals, and current practices. Of course, in that process, they may themselves change, and their changes as well as those to the innovation need to be understood as part of the system.

The Setting in Which the Innovation Appears

The shift in perspective from the view that realizations are distortions of the ideal to one in which realizations are creations that result from active problem-solving has implications for the sorts of questions researchers need to ask in evaluating innovations. With this perspective, the social context in which the innovation is used becomes central. Questions relating to cultural, institutional, and pedagogical contexts need to be addressed. To answer these questions in full is a formidable task, but focusing on a few specific aspects may go far in providing what is needed for a situated evaluation.

The Realizations of the Innovation

The third aspect of a situated evaluation is to study the realizations of the innovation in different settings. This means, first, to examine the ways the innovation was used and search for the reasons that changes occur. This includes analyzing how the idealization was consonant or dissonant with existing social practices. It also includes studying how the innovation's use led to new social organizations. Second, is to look at the variety of uses across settings, treating each of these as an independent re-creation of the innovation, rather than as a data point for an aggregate statement about the innovation. Third, is to examine changes in the design of the innovation brought about by its use and the ways these changes relate to new practices.

Comparisons of Situated Evaluation with Standard Evaluations

A key difference between situated evaluation and the standard frameworks is that its purpose is to learn first how the innovation is used, not how it ought to be changed or whether it has claimed effects. Because it is concerned with actual use, it does not focus on the innovation or its effects, but rather on the social practices within the settings in which the innovation is re-created. This shift in focus has implications for the audience of the evaluation, the role of setting variability, the tools for evaluation, the time of assessment, and the presentation of results.

Focus

Standard evaluation is concerned either with properties of the innovation alone or with its "effects." In contrast, situated evaluation focuses on the way the innovation becomes social practices.

Audience

Situated evaluation results can be used by both users and developers. Users can make decisions not only about whether to use the innovation, but how to use it in their particular context. Developers can learn how to revise the innovation taking into account the variations in use.

Purpose

For situated evaluation, the audience is broad, as are the actions that follow from the findings. The results could lead to developers changing the innovation, to users changing their practices, to adoption of only parts of the innovation, or to deeper understanding of the process of use.

Variability of Settings

The central concern for situated evaluation is with characterizing the way an innovation comes into

being in different contexts. Because the audience for the evaluation wants to know how to improve the use of innovation, it is useful to have a variety of contexts that they can compare to their own setting or to ones they might create. Thus, it is most appropriate when there are a variety of contexts of use, and differences across those settings.

Measurement Tools

With situated evaluation, the emphasis is on differences across contexts. This emphasis implies the use of qualitative tools, including observations and interviews that are structured to elicit information about recurring social practices in the setting and to draw out differences among realizations.

Time of Assessment

Situated evaluation can start once the innovation is developed enough to be placed in a classroom. This is in contrast to formative evaluation, which might start even earlier, in a laboratory setting. Situated evaluation can continue well after the developers have finished. It could be done before summative evaluation as a way to identify sites or issues to study, or afterwards as a way to study the process of change.

Results

Because a situated evaluation seeks to characterize alternate realizations, it requires multiple, detailed descriptions of specific uses. Changes need to be described using appropriate quantitative or qualitative representations, but more importantly, the reasons for changes need to be discussed and linked to characteristics of the settings of use. The process of change, including changes in the innovation, in the users, and in the setting, becomes paramount.

Situated Evaluation and Ethnographic Inquiry

Situated evaluation significantly differs from standard (summative and formative) evaluations that start with the given and ask how to improve it. Hence, evaluators who approach from a situated evaluation perspective would not simply identify the strengths and weaknesses of a technology and generalize the conditions for successful implementations. Situated evaluation also does not pursue wide and decontextualized dissemination of an innovation across different settings. Instead, through contrastive analyses and narrative accounts, evaluators seek to create a shared space for multiple technology users to reflect their values and practices so that they can continue re-creating their technology uses through practice. The audience for the evaluation would also want to compare to their own setting or to ones they might create.

Situated evaluation resembles the "sustained and engaged nature" of ethnography and extensively uses ethnographic methods, "long-term participant observation with in-depth interviewing" (Miller, Hengst, & Wang, 2003). To understand the process of change and to excavate different views or interpretations of socio-technical changes within contexts, situated evaluation demands evaluators' relatively long-term and ongoing engagement. An's study (2008) shows how ethnographic inquiry and methods have guided her situated evaluation of an alternative computer training practice implementing community service. According to her study, the methodological emphasis of situated evaluation needs to continuously create a dialectic between the "contextual" and "narrated" worlds in order to generate credible results throughout data collection, analysis and reporting. Different natural settings and uses of an innovation cannot be arbitrarily analyzed and compared in parallel. Rather, situated evaluation develops the researcher's continuous and meaningful construction of knowledge through sensitive use of multiple research methods.

Situated evaluation is also based on the idea that the researcher-participant relationship can

Table 2. Comparisons among the three types of evaluation

	Formative	Summative	Situated
Focus	Innovation	Effects of the innovation	Social practices
Audience	Developer	User	User (but also developer)
Purpose	Improve the innovation	Decide whether to adopt innovation	Learn how the innovation is used
Variability of Settings	Minimized to high-light technology	Controlled by balanced design or random sampling	Needed for contrastive analysis
Measurement Tools	Observation/Interview/Survey	Experiment	Observation/ Interview
Time of assessment	During development	After initial development	During and after development
Results	List of changes to the technology	Table of measures contrasting groups	Ethnography

significantly shape the researcher's understanding of the insiders' perspectives. What enables scientific inquiry is not the elimination of subject errors or biases, but the researcher's on-going, self-reflective learning to understand the multiplicity and complexity of modern social reality by carefully observing practice. Hence, evaluators weave possible interpretations about the phenomena on the basis of what they hear and observe. In this sense, conducting situated evaluation is a constructivist and historical process of learning for evaluators to make meaningful knowledge.

Briefly, situated evaluation requires an evaluator's sustained, extensive, and self-reflexive engagement. That effort is worthwhile if one wants to understand diverse cultural adaptations of technology and the process of technology design and use *in situ*.

A STUDY OF ELECTRONIC QUILL IN USE

Quill (Bruce, Michaels, & Watson-Gegeo, 1985; Bruce & Rubin, 1984; Liebling, 1984; Rubin & Bruce, 1985, 1986) was an approach to the teaching and learning of writing built around a software system that included both tools and environments for writing. From 1983 to 1987, it was used throughout the U.S. and Canada, primarily in upper-elementary and middle-school grades. Quill is no longer commercially available, but the Quill studies show extensive classroom data on its use. The studies examined how Quill was realized in different ways in diverse settings. They also looked at the details of the implementation processes to understand how the realization reflected the unique characteristics of Quill, as well as the particular classrooms in which Quill was used.

One of the Quill **s**tudies is described here in order to demonstrate how a situated evaluation can be conducted in a specific case. This study focused on the various ways that Quill**'**s goal of purposeful writing was realized through the use of Mailbag, one component of the Quill software. Mailbag was a version of email used by the Quill students, years before many people became aware of it. The goal of the study was to understand how realizations of an innovation were created, and to use real classroom examples for insight into the process of integrating new technologies into teaching.

The following presents the findings in two major sections: the idealization of Quill and realizations of Quill. The latter describes alternate implementations of Mailbag and how the integration of students' and teachers' purposes and habits with the innovation produced different realizations. The data gathered include writing by the teachers about their own classrooms, student writing, electronic mail (both from Mailbag and from a network for teachers), and field notes from classroom observations.

The Idealization of Quill

Quill's design was based on research on composition, and encompassed prewriting, composing, revising, and publishing aspects of the writing process (Bruce, Collins, Rubin, & Gentner, 1982; Flower, 1981; Flower & Hayes, 1981; Graves, 1978, 1982; Newkirk & Atwell, 1982). It included a text storage and retrieval program (Library), a note-taking and planning program (Planner), and an electronic mail program (Mailbag), all supported by a text editor (*Writer's Assistant*; Levin, Boruta, & Vasconcellos, 1983).

In its software, accompanying curriculum (Quill *Teacher's Guide*; Bruce, Rubin, & Loucks-Horseley, 1984) and teacher workshops, Quill embodied a philosophy for teaching writing. Quill emphasized the process of writing, including the importance of both planning and revision. The contrast between Quill classrooms and traditional classrooms is highlighted in Table 3. On the left is a gloss of what we call the idealization of Quill, that is, the view of what Quill was supposed to become in classroom use. On the right are parallel descriptions of a more traditional writing class. Many teachers tried to integrate Quill with some of these discrepant practices. Although major changes in the teaching of writing have occurred since then, many classrooms still approach writing in the "traditional" way. Moreover, the issue of how classroom technology adoption is inseparable from pedagogy is still relevant (Mishra & Koehler, 2006)

A central element within the idealization of Quill was an emphasis on real audiences and purposes, which was expressed in the software, teacher's guide, and training. In the software, Mailbag, in particular, reified this emphasis on audience and purpose. Combining features of the post office, the telephone, and a bulletin board, it facilitated direct communication among students, groups of students, and teachers. With activities suggested in the Quill *Teacher's Guide*, it encouraged a variety of purposes for writing that students seldom experienced in school: "chatting," persuading, informing, instructing, and entertaining. It also motivated students to write more by introducing a personal element into the experience.

Many teachers introduced "writing as communication" to their students through Mailbag. Since they had used Mailbag extensively during training, teachers appreciated the differences between sending Mailbag messages and standard classroom writing assignments. They saw Mailbag as a way to help students understand writing as a communicative act through participation in writing activities that demanded a real audience and purpose.

Realizations of Quill

The realization of Quill in any real classroom was a re-creation that drew upon the idealization, but was usually more dependent upon characteristics of the situation of use, institutional forces, the teacher's goals and teaching style, the students, and idiosyncratic technical details, such as the number of computers or room layout. Thus, the many forms of Quill-In-Use differed markedly from the original conception.

Of course, each teacher understood the idealization of purposeful writing in Quill in his or her own way, and the variety of realizations were due in part to different teachers' interpretations of our message. What mattered was not just Quill's conception of purpose, but that of the people who used it: What did teachers and students think writing was useful for? How did they use writing to accomplish personal goals? What did teachers think students should learn about writing in school? What natural goals for writing existed in classrooms or community contexts?

In most classrooms, Mailbag use *did* lead to more purposeful writing. Students saw Mailbag as an unconstrained writing environment and were thus able to use it for their own purposes. But the specifics of this use took many different forms, often surprising both us and the teachers involved. A few teachers regarded the openness of the Mailbag environment as a pedagogical problem, and in these cases, little purposeful writing with Mailbag occurred.

Table 3. Contrasts between QUILL and traditional classrooms

QUILL Classroom	Traditional Classroom
Prewriting	Sit and write
Topic choice	Designed topic
Multiple genres	Mostly narrative
Multiple real audiences	Teacher as audience
Real purposes	Writing for a grade
Conferencing	Red marks as response
Revision	Editing
Collaboration	Hidden papers
Sharing writing	Isolated writers
Writing across the curriculum	Writing in English class

For several teachers, Mailbag and its built-in assumptions were completely consistent with their current classroom practices and their attitudes toward teaching writing. These teachers firmly believed in "student-centered education" and in students' feeling ownership of the process and product of their work in school. They saw Mailbag as a welcome extension of the way they already taught writing. They were comfortable with students' deciding when, where, why, and on what topics to write. For instance, Bonnie's multigrade, village-school classroom reflects this symbiotic use of Mailbag. Students used the program frequently and enthusiastically from the beginning of the year. Bonnie offered the following comments about her class' early use of Mailbag:

Probably the best thing about Mailbag is communicating. The person at the keyboard is in complete control. I never made any Mailbag assignments. Students could use it or not, decide what they would say, to whom, when, how often, and why.

The Mailbag messages written in this class show their oral-language character. Students seemed to regard Mailbag as an environment in which they could carry out the same communicative functions for which they used oral language. Although many messages contained nonstandard grammar or spelling, Bonnie never corrected any student message. She considered Mailbag to be in the students' domain, where spelling and punctuation were secondary to just plain communicating.

In Bonnie's classroom, students expressed their control over Mailbag by deciding both when to use Mailbag and when to stop using it. Several other teachers also found that students' enthusiasm for Mailbag diminished as the year went on, but Bonnie's comment about this shift reflects again how her educational views easily encompassed such as change:

By springtime the Mailbag was hardly used at all. At first I was disappointed, then pleased. The students had learned that there were appropriate forms of communication for specific needs.

Especially in small classes where students knew each other well and saw one another frequently outside of school, the kind of communication Mailbag facilitated was mostly redundant. As Bonnie implies, students had become more sophisticated about audience and purpose and were not satisfied with a communicative situation that did not increase their access to real audiences.

In one class, however, interest in Mailbag remained strong during the entire year. Hans taught high school in Bonnie's village and used Mailbag with his class after learning about it from Bonnie. He designated one disk as the students' private Mailbag disk and promised the class that he would never read it. The students continued to send messages on the disk all year, and Mailbag remained the most popular Quill activity. As the year went on, Hans actually had to ration Mailbag's use because he wanted students to use the computer for other kinds of writing as well. Why did Mailbag remain so popular in this class? Certainly at least one influence was the unique audience Hans defined for Mailbag messages. It appears that the secrecy of the disk made the communication environment unusual enough that students did not consider it redundant with face-to-face communication.

Since many Quill classrooms had only a single computer, using Quill required some teachers to

rethink their classroom management practices. How were they to integrate a free-form activity like Mailbag into a more structured day? Wilma, a fifth-grade teacher, invented a procedure to deal with the changes in her classroom structure. Wilma's students' excitement over Mailbag was particularly significant to her, since one of her goals for the year was to help her students learn to enjoy writing. While she was enthusiastic about Mailbag's effect on her students, she was troubled by its classroom management consequences:

When we started using Mailbag, I had a problem with my students wanting to be back at the computer constantly checking to see if they had any mail or not. We decided we needed to devise a system that would solve the problem. We talked about what we could do, and soon came up with a mailbox poster, which worked quite well. We each wrote our computer code name on a Library book card pocket, and glued the pockets to a piece of poster board. The poster board was then hung on the wall behind the computers. Another pocket was added to hold slips of red paper. When a student left a message on Mailbag for White Knight, he or she would put a red slip into White Knight's pocket. After While Knight read his messages, he returned the red slips to the extra pocket.

The classroom management issues were so central to teaching with Quill that Wilma's idea spread around the community via our technical assistance visits and the teachers' electronic mail network. The classroom management problem turned out to be a common one, and many teachers adopted Wilma's solution.

Not all integrations of purposeful writing with Mailbag into the classroom grew out of a symbiosis between Quill and a teacher's purposes. In one case, a teacher completely rejected Mailbag because it conflicted with her views of the appropriate way to teach writing. This teacher started out using Mailbag in the usual way, and students began sending messages according to their own purposes, such as love letters to one another. When the teacher discovered this, she immediately made Mailbag unavailable since she felt that the messages students had been exchanging were not appropriate classroom writing. The gap between her pedagogical assumptions and those underlying Quill was too great.

In a slightly different attempt at integration, a fourth-grade teacher tried to combine a fairly traditional writing assignment with Mailbag. The idea for her assignment came from the Quill *Teacher's Guide*, where we had described a "Classroom Chat" activity, based on a popular newspaper column called "Confidential Chat." In the newspaper prototype, writers send anonymous letters describing their personal problems; they usually adopt a pseudonym that refers to their situation (e.g., Hassled Mom or Concerned Commuter). Quill's variation had students sending anonymous messages to the Mailbag's Bulletin Board in order to discuss personal problems anonymously with others students in the class. Mixing the pseudonymous personal consultation idea of Classroom Chat with a more traditional teacher-directed writing assignment, the teacher sent the following message, complete with pseudonym:

Dear Classy Computer Kids,

There are five members in my family and only one shower. Because I'm the youngest member of our family, I'm the last one in line to take a shower. By then, there's usually no more hot water and not too much time for me to wash behind my ears! It's a horrible way to start a day. What can I do to solve this problem?

Cold, late, and dirty,

I. Needabath

The following tongue-in-cheek student response hovers between reality and fantasy, much as the original letter did:

Dear I. Needabath,

I think you should tell the first person that takes a shower you have to go to the bathroom. Then they should let you go before they take a shower. Quickly lock the door and take your shower. You will have enough of time to wash behind your ears.

Sneaky and Desperate,

Kerry N. and Jenny B.

An interesting problem emerged in this activity because of the conflict between the teacher's goals and the presuppositions of Mailbag. The form of the teacher's message mimicked that of the standard confidential chat letter, but the students in the class all knew who had sent the letter and, even more important, that it posed a fake problem. Thus, their assignment was to pretend they were answering a real letter from a needy person, while knowing it was an imaginary letter from their teacher. While students produced imaginative replies, we observed that students were confused about their audience (their teacher or I. Needabath) and their purpose (real or fantasy) while they were writing. This lack of clarity was most obvious when they were signing their names; many were not sure whether to use their own names or to make up clever pseudonyms. In this situation, the teacher's assignment worked only weakly as an attempt to integrate two inconsistent pedagogical goals.

Teachers were not the only ones for whom Mailbag offered new opportunities for integrating technology with personal goals. In several classrooms, students found in Mailbag, a new and unexpected way to pursue their own purposes in school. Students in Syd's fifth-grade class in Juneau discovered that Mailbag could serve an unexpected purpose in their relationships with others in the classroom. One of Syd's students "saw himself without friends"; Syd worried about both his academic and social development:

He chose late Friday for his time [on the computer] *so he could miss it, not realizing that more often than not, late Friday was the easiest time for me to be his partner. The other children, in spite of their ugliness to one another, were able to sense his feelings and began writing* [Mailbag] *letters telling how much they liked him and that they wanted to be his friends. There is no way to describe the face of this handsome, brown-eyed boy as he read these notes, frequently slipped into his desk anonymously. He sat near me for obvious reasons and I would watch him remove one and literally clutch it to his chest.*

Syd's students, having learned the power of writing, chose to use it to be kind to a troubled student with whom face-to-face communication was difficult.

Many students in field-test sites in Alaska used Quill to answer a pressing communicative need; they were unable to be in touch easily with people outside of their own villages and they had no way of meeting new people. Partly in response to their needs, the Quill project in Alaska instituted a long-distance network, implemented through a combination of human travel and U.S. mail (Barnhardt, 1984).

On one of our trips through Alaska to visit classrooms, we carried a disk called "Supermail." This was a very slow, but still effective, way to carry electronic messages from one village to the next, when even dialup connections were rare and unreliable. The Supermail disk facilitated communication for some students in Nikolai, as Don, their teacher, explains:

What made this activity fun for my class was the fact that Chip had just come from Telida and the most recent messages on the disk were from cousins and playmates upriver. This connection made the notion of sending hellos to strangers Outside seem less threatening.

Don reflects his students' view of the world by referring to the rest of the United States outside Alaska as Outside, to them a vast and little-known area. The Supermail disk provided an opportunity for the students to be in touch with the outside world;

it made the transition gradual by allowing them to expand their understanding of communication from a familiar audience to a larger and unfamiliar audience Outside.

The crucial point for us here is that Supermail was nowhere envisioned in the original Quill design, or idealization. It didn't exist at all for most Quill classrooms and users. Instead, it emerged from the unique social and geographical situation of Alaskan village schools, and was thus as much a new technology as any other Quill component, although one created through use. For some in Alaska, Supermail became a salient part of the Quill experience. In a standard evaluation approach, we might footnote it as a user adaptation of the pre-existing program; with situated evaluation we describe it as an innovation created through practice.

It may be helpful to refer to Dewey's (1922) critique of the dualism of means and ends. He discusses how "means and ends are two names for the same reality"; that they are convertible, one into the other:

Only as the end is converted into means is it definitely conceived, or intellectually defined, to say nothing of being executable. Just as end, it is vague, cloudy, impressionistic. We do not know what we are really after until a course of action is mentally worked out. (p. 29)

Standard evaluations tend to assume a separation of means and ends: The program is a known, fairly well-defined means and the desired outcome is a known and somewhat fixed end. Situated evaluation, in contrast, assumes that means are created as much through use in a community or classroom as they are through development in the lab. Ends emerge as well, reflecting those new means. Supermail was an innovation created through use, because of ends that were unknown during development, or at best "vague, cloudy, impressionistic." Its creation defined new ends for the participants.

CONCLUSION

In the Quill study, the use of Mailbag for purposeful writing is only one area in which alternate realizations of Quill arose. In every case in which Quill raised significant pedagogical issues, teachers had to confront the relationship of their past practices to those implied by Quill. This resulted in a variety of solutions to the need to integrate Quill with sometimes disparate goals, values, and practices.

Our analysis views these as creative solutions to the complex and ill-defined problems teachers or, for that matter, anyone, must solve when presented with an opportunity to change. As we see through this study of Quill in use, an innovation is not an object that can be packed inside a box, but rather a set of practices that emerges from the social setting of its use. Thus, in a sense, the user does not accept or reject an innovation but instead creates it through action in the world.

The key notion about situated evaluation, as also shown in the Quill study, is that it does not postulate an *a priori* innovation to be used in various settings. Rather than investigating the practices or impact based on such an innovation (as formative or summative evaluation would do), it seeks to discover what innovation comes into being through practice.

Accordingly, situated evaluation highlights the power of the social context to affect the use of a new technology. How the features of the technology interact with human needs, expectations, beliefs, prior practices, and alternative tools far outweighs the properties of the technology itself. This does not mean that we ignore the influences of developers' visions and technical designs. Instead, we seek to develop a holistic understanding of an innovation as a mutual adaptation between technology and its situated social settings. This understanding of the idealization and various realizations of an innovation can help improve further re-creations of a socio-technical system.

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KEY TERMS

Situated evaluation: An approach to uncovering or articulating the emergence of innovations through practice, assuming that innovations are mutually constituted by social practice and some external input.

The innovation-in-use: Different ways in which the innovation is realized and thus created by diverse users. Situated evaluation, which is open to new variables and sensitive to alternate uses and interpretations, focuses on understanding *innovation-in-use*.

Idealization: The elements of the innovation as intended by developers.

Realization: The ways the innovation was used, modified, and re-created by users *in situ*.

Appropriating technologies: Users actively rethinking the meaning and use of a technology and reinventing its practices within their situated, cultural contexts.

Technocentrism: The tendency to focus on technological artifacts or mechanisms to the exclusion of social, cultural or historical perspectives.

ENDNOTE

[1] This chapter adapts portions of *Electronic* Quill*s: A Situated Evaluation of Using Computers for Writing in Classrooms* (1993) by Bertram C. Bruce and Andee Rubin.