Evaluation Strategy for NSDL

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The overarching question for the NSDL evaluation should be, "How does this online network of learning environments and resources support education?" Implied within that question are crucial ones about the NSDL as a defined technology, such as "How are people using it? How well do the mechanisms of acquisition, classification, access, and retrieval work? What is the quality of the resources?" as well as questions about the construction process, such as "How are the collections and tools changing? How well does the distributed development process work?"

The subsidiary questions are crucial, but in the final analysis they address only part of the overarching question. The reason is that the NSDL is what Roland Barthes (1974) calls a *writerly text*, one which locates the reader as a site of the production of meaning. Regardless of how well resources have been collected and organized, curricula have been designed, or even training delivered, the power of the reader/user to appropriate the system in ways that make sense within a local context should not be underestimated. Accordingly, how well NSDL supports education depends on how it is distributed, interpreted, and re-created through use (see Merkel, 2002, for an excellent study of technology use in low-resource communities and the many disjunctions between well-meaning developers and the situation of community members).

For example, in a recent dissertation, Xiaohui Wang showed how children collaborated in a first-grade classroom. The teacher had allocated five minutes for each child at the computer. On their own, children developed a system in which one child used the left half of the keyboard, a second used the right half, and a third used the mouse. Thus, they managed to get 15 minutes each at the computer, while achieving greater success in navigation or game-playing than any would have alone. The meaning of the applications, the children's use of time and space while interacting with the computer, and the learning that occurred were only in part determined by the hardware and software design. A similar re-interpretation and re-design of the human-computer system is repeated in many contexts and nearly always underestimated by developers (see Twidale, 2003, for similar examples in adult use).

A reason for that underestimation is that dominant approaches to analyzing the effects of technology or new media (see Gauntlett, 1995, 1998) follow the pattern:

- analyze the technology
- describe its effects

⊡ interpret those effects

Are there other ways to understand the role of technologies? I'd like to suggest several approaches, which provide lenses for seeing the phenomena of user appropriation as well as frameworks for interpreting what actually happens when the system is deployed (see also, Bruce, 1999, 2003).

Pragmatic technology: One sense of "pragmatic technology" is the common-language notion of technology that works to meet real human needs, accommodates to users, and is situated in time, place, and setting. A second, related concept, comes from pragmatist theory (e.g., Addams, Dewey, James, Mead, Peirce), in which technology is seen as the outcome of resolving a problematic situation. The latter sees technologies as both means of action and forms of understanding (Dewey, 1938; Hickman, 1990). This is a constructivist view of technology itself, which is helpful for understanding divergent or unintended uses. It also helps in understanding whose problem is being addressed. For example, with NSDL, a problem may be defined as organizing a collection of high-quality resources on biology, whereas the high-school teacher user may be concerned with improving test scores. These two problems may have some overlap, but their difference needs to be understood if we are to make sense of how the system gets used, or not, in that classroom.

Situated evaluation: Closely related to the pragmatic technology conception situated evaluation, a framework for understanding innovation and change (Bruce, Peyton, & Batson, 1993). "This framework has several key ingredients: It emphasizes contrastive analysis and seeks to explore differences in use. It assumes that the object of study is neither the innovation alone nor its effects, but rather, the realization of the innovation-- the innovation-in-use. Finally, it produces hypotheses supported by detailed analyses of actual practices. These hypotheses make possible informed plans for use and change of innovations" (Bruce & Rubin, 1993, p. 215).

Adaptive structuration: Use of any new technology is a long-term process of adaptation (Desanctis, & Poole, 1994). This is not just to say that it takes time to learn how to use a new tool; more deeply it is that context determines use and in turn use determines context. The consequence is that we see processes of substitution, enlargement, reconfiguration. It then becomes crucial to ask where we are in a process whose end is not in sight. The *Concerns-Based Adoption Model* which emphasizes the change process versus a snapshot of use is one tool that can be used to examine those processes, especially when it is coupled with a dynamic (pragmatic technology) model of the innovation.

Sociotechnical system: Understanding the system as comprising human activity, spaces, artifacts, tools, and communications media. What else in the local and extended environments shapes the technology's use? Various approaches such as information ecologies (Nardi & O'Day, 1999) provide ways of understanding how NSDL, as comprehensive as it may be, is only a small actor within the network of human and technology actors in the school.

Community inquiry: Taken together, these lenses point toward a view of evaluation that is dynamic, situated, participatory, and open to new possibilities. Rather than conceiving the classroom as a recipient of a finished and tested technology, we might see it instead as an example of a *Community Inquiry Laboratory*, a place where members of a community come together to develop shared capacity and work on common problems. "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. "Laboratory" indicates a space and resources to bring theory and action together in an experimental and critical manner. A CIL is most importantly a concept, not a technology in the narrow sense. The NSDL then becomes one resource in that CIL, and evaluators can ask what roles it serves and how it functions to support community inquiry.

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