Electronic Technologies and Instruction: Tools, Users, and Power

Frank A. Dubinskas and James H. McDonald, eds.

National Association for the Practice of Anthropology
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Introduction

Knowledge Building and Knowledge Access: Teaching with Electronic Tools

Frank A. Dubinskas

This volume, *Electronic Technologies and Instruction: Tools, Users, and Power*, addresses issues at the heart of our changing anthropological teaching and its politics—the processes of building knowledge and creating access to knowledge resources. The changes we discuss emerge from and are built with new electronic teaching technologies. The introduction of these technologies transforms the media, speed, density, and the character of the work of students and teachers, and it alters the organization and presentation of information to both. Some of these technologies also provide information on the learning process itself by automatically recording data on accuracy, quality, and frequency of use.

The new teaching tools, however, are not simply dumb instructions with an "impact" on teaching; but, rather, they are active ingredients in a process of redistributing knowledge and power among students, teachers, administrators, and the organizations or communities where they are used. As Stephen Barley’s ethnographies (1986, 1990) of medical CAT scanners demonstrate, introducing a high-tech tool creates an occasion for restructuring social relations, but tools by themselves do not determine social and organizational—or pedagogic—outcomes. This inability to predict social consequences from the technology alone necessitates a detailed social study of implementation contexts to help understand the dynamics of the process. At the same time, the character of a technical system does have an influence in shaping the possibilities for its use. There is a flexible balance between the relative influence of tools versus users, and because electronic tools are often as flexible as their human users, this balance is a continually shifting one.

Our aim in this volume is to shed light on this complex and shifting balance by presenting five studies of new tools and teaching processes in their social contexts. Among the technical systems we address are:

- Interactive tutorial software (Hamill and Marchant)
- Hypertext software for communication and teaching (Mason Weiss, Metzger, and McDonald; Bader and Nyce)
- Telecourses (Segal)
Computers and teleconferencing (McDonald; Mason Weiss, Metzger, and McDonald)

The social contexts range from an individual user to classroom settings to dispersed electronic networks of students ("distance learning") to community and regional systems of educational administration.

As we examine these new tools and learning contexts, the concept of "knowledge management," comprising knowledge building and access to knowledge, can help separate different issues and realms of analysis. The teaching and learning processes are centrally concerned with building and spreading knowledge. These two are intimately linked, because the classroom learning process builds knowledge; and those same classroom interactions open access to knowledge bases. Differentiating building from access, however, creates an order to how we address the issues. The first aspect, knowledge building focuses on the ways that students learn to think about and perform in a subject area. Here we explore the notions of how well (or how fast or how accurately) students become familiar with either a body of knowledge—a "knowledge base"—or a set of intellectual tools that allow them to create and navigate through such knowledge. In other words, "Did they learn the stuff?" Knowledge access opens a related discourse on the politics of how students might accomplish that learning. Here we examine social barriers to and facilitators of learning, especially those rooted in the inherent power asymmetry between teachers (or educational institutions) and their students. The discussion of access also widens the scope of discourse to contexts outside the classroom that impinge on the learning process, such as schools, communities of students and teachers, administrators, and social, political forces, and agents from ever widening arenas of relevance. Our articles consider contexts as narrow as learning alone or in small groups, to the broad questions of political and cultural hegemony in the United States.

New electronic technologies, in every case, have a central role in stimulating a transformation of the teaching and learning experience. Two issues become central to this transformation: (1) the user’s encounter with new technical systems and (2) the transformations of power relations that accompany or are engendered by these tools. By framing these issues as knowledge building and knowledge access, we propose a model for examining similar new technology implementations that are not strictly focused on teaching or on anthropology. In the following section, I define and describe several dimensions for examining our five case studies—tool transparency; task clarity; control, flexibility, and skill; and empowerment. These dimensions also recast our teaching studies more broadly as examples of new technology implementation.

"Glass Tools" and Knowledge Building

Tool transparency addresses the character of electronic tools and the intimate relation between tasks and tools. Our case studies focus primarily
on the user's point of view rather than the tool designer's, because most of
the tools we discuss appear to the naive student user as "finished" objects.
However, it is also necessary to consider the high potential flexibility of soft-
ware tools and, hence, their malleability in the hands of users. Further, this
malleability leads us to consider the tool design process, too, because so-
phisticated users become de facto "designers" as they learn about and
modify their flexible tools. Considering the tool design process also re-
minds us that the user-to-designer relationship is critical for choosing or
producing effective tools. The tool transparency issue directs our attention
to whether and how a tool facilitates (or impedes) the user in getting a task

The "glass tool" or "glass box" tool is a metaphoric extension of the en-
gineer's notion of a "black box." While a "black box" is an opaque technol-
ogy that masks the process or reasoning by which it functions, originally a
"glass box" meant a tool that allows the user to see the underlying pro-
cesses that make the tool work. At first blush, this seems like a positive attrib-
ute; however, the problem of "transparency" is more complex. Is a tool
"transparent" enough to the user so that the user can focus on the task to
be accomplished, not on the details of how to use the tool itself? Or rather,
does the tool embody knowledge about the task that must be made "vis-
ible" in order for the user to understand the task process? This tool-to-task
relationship links four issues with questions we can ask of the cases de-
scribed in this volume.

1. Tool transparency: Do you see or see through the tool, and how hard
   is the tool to use?

2. Task clarity: Are the tasks clear to students (or other users), and is the
   relation of the tool to the task also clear?

3. Control: Does the user have control of the tool, or does the tool force
   the user into a predetermined mode of work?

4. Flexibility and skill: If a tool is flexible, who is empowered by skills or
   knowledge to take advantage of this flexibility?

Tool transparency is concerned with what a tool reveals or conceals,
and thus also how easy a tool is to use. No matter how 'flashy', sexy, or en-
gaging a tool may seem on its surface, getting to the task objective should
be the prime driver for picking a tool. Some tools force you to jump through
hoops to get your work done, and other tools ease the path, enhancing your
ability to do a good job. The first kind of "hoops" tool requires a lot of learn-
ing and attention to the tool-manipulation process itself, but manipulating
the tool does not enhance your knowledge or productivity in the domain of
your objective. Take word processors as an example. If you had to type the
source code for every formatting action you wished to execute in a word-
processing program, you would either produce less elegant, less legible
documents, or you would spend hours adding cryptic instructions in brackets like "\\ital " before or after every change of style-like italicization, indentation, spacing, or alignment. You must learn a new vocabulary and syntax for creating style—a "command language"—but this new learning task only marginally facilitates your primary writing objective. The system is opaque and must be deciphered in order to get to the task of writing. By contrast, a menu or icon-driven word-processing system that is also "WYSIWYG" facilitates producing text the way you want it to look. The complexity of manipulating text on the screen or page is hidden in the software's source code behind graphic icons or menu items that are readily accessible. This system makes formatting a document relatively easier and allows the user to focus on the fundamental objective of writing.

In this case, the word-processing technology mediates between the user and the task; so it makes sense for its functions to be relatively invisible or transparent. You see through the word processor to the content of your document, but tool transparency is not always the most desirable aim. Some software, including some of the educational systems we describe here, embodies aspects of the subject matter in the way it works. In this case, you want to make the internal processes or manipulations of the technology visible. For example, in software that sorts, correlates, or analyzes data, it may be a great advantage to have these processes visible or at least accessible to students, so they can learn the analytic procedures of the system. A "glass tool" allows the student to see the inner workings of an analytical process—learning to reason, rather than just focusing on results.

The value of opacity or transparency depends on context. One might want a tool to provide different levels of visibility of its logic for different users, based upon their expertise. Beginning and advanced students might use the same tool to different ends, so the capability to alter the tool itself is an important criterion to consider. Seely-Brown and Duguid (1990) propose three kinds of transparency:

- Domain transparency
- Internal transparency
- Organizational transparency

Domain transparency is the ability to make the causal reasoning behind a technical system apparent to the user. But, as they point out, some systems are inherently complex or abstruse, so that simply laying them bare does not make them accessible. "But it is possible in certain circumstances to build a representative model of the relevant causality that allows users to develop a helpful sense of their role and their tool's role in ongoing activity" (1990:29). The icon-driven software of Apple's Macintosh program exemplifies such a model. It represents activities in the operating system of the computer by translating and metaphorically simplifying them into visual symbols that evoke common experiences; its trashcan icon, for example, represents the "delete" function. Internal transparency is a less mediated