

Chapter 6.16

Building Educational Technology Partnerships Through Participatory Design

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INTRODUCTION

Educational technology provides many examples of how efficient software development and deployment is not enough. Teachers work in a complex and dynamic context in which measurable objectives and underlying values collide on a daily basis. Traditionally, teachers work in isolation from their peers; individual teachers have well-established personal practices and philosophies of education. Teachers have enormous discretion with respect to what goes on in their classrooms, yet are also routinely interrogated by supervisors, by parents and other community members, and by educational bureaucracies. This has led to an abiding tension in the culture of schools: Teachers' innovative practices are often not adequately acknowledged or valued, and at the same time, teachers often passively resist school reforms that are imposed top-down.

Technology is a particularly problematic element in the culture of schools. The isolation and

discretion of the teacher's work environment requires that technology for classroom use be highly appropriate and reliable. Yet it is generally assumed that teachers are to be *trained* on new technologies, not asked to *define* what those technologies should be. From the teacher's standpoint, classroom technology often is itself the problem, not the solution. This culture of technology development in the schools has been singularly ineffective—film and radio in the 1920s, television in the 1950s, and computer-assisted instruction in the 1980s, among others, have been notable failures (Tyack & Cuban, 1995).

An alternative to merely efficient technology development is *participatory design*, the inclusion of users within a development team such that they actively help in setting design goals and planning prototypes. This approach was pioneered, and has been widely employed, in Europe since the 1970s, and now consists of a well-articulated and differentiated set of engineering methods in use worldwide (Carroll, 2000; Clement & Van den

Besselaar, 1993; Muller, 2003; Muller, Haslwanter, & Dayton, 1997; Rosson & Carroll, 2002).

In 1994, a design collaboration was formed between Virginia Tech and the public schools of Montgomery County, Virginia. The objective was to develop and investigate a high-quality communications infrastructure to support collaborative science learning. Montgomery County is located in the rural Appalachian region of southwestern Virginia. In March 2000, one of its high schools was listed among the top 100 in the US by *Newsweek* magazine. However, in others, physics is only offered every other year and to classes of only three to five students. The initial vision was to give students in this diverse and dispersed school district access to peers through networked collaboration.

We felt it was critical for the teachers to contribute as collaborators in design analysis, implementation, deployment, testing, and refinement, and as leaders in the development of courseware and classroom activities that would exploit the software. For a classroom-technology partnership to succeed, the university researchers must eventually fade and leave the teachers to maintain and develop its achievements. In the end, the technology-development goals of this project were achieved, though this is not the topic of this paper (Isenhour, Carroll, Neale, Rosson, & Dunlap, 2000).

BACKGROUND

We analyzed our participatory engagement with the teachers as “developmental” in the sense of Piaget and Inhelder (1969) and Vygotsky (1978). We believe the teachers developed qualitatively different roles through the course of our collaboration. In some cases, these roles were suggested to them; in other cases, they defined and claimed new roles. But in all cases, these transitions exemplified the defining characteristics of *developmental change*: active resolution of manifest conflicts

in one’s activity, taking more responsibility, and assuming a greater scope of action. Each successive stage can be seen as a relatively stable organization of knowledge, skills, and attitudes that resolves the instigating conflict.

During the six years of this project, we distinguished four stages in our collaboration with the teachers. At first, the teachers were *practitioner-informants*; we observed their classroom practices and we interviewed them. Subsequently, the teachers became directly and actively involved in the requirements-development process as *analysts*. Later, the teachers assumed responsibility as *designers* for key aspects of the project. Finally, the teachers became *coaches* to their own colleagues within the public school system.

In a classic Piagetian example, a child in the preoperational stage perceives single dimensions of quantity. This produces conflicts: A given quantity of liquid poured from a short, wide container into a tall, thin container appears suddenly to be more, but of course cannot be more. These conflicts eventually precipitate a cognitive reorganization called the concrete operational stage, in which constant quantities are perceived as constant regardless of varying shapes and arrangements.

Developmental change in adults is of course more complex. The stages we describe are not singular competencies, but relatively complex ensembles of collaboration, social norms, tool manipulation, domain-specific goals and heuristics, problem solving, and reflection in action. They are social constructions achieved through enculturation, constituted by the appropriation of the artifacts and practices of a community (Vygotsky, 1978).

In the Piagetian notion of stages in child development, successive stages build upon the cognitive structures and enabled activity of prior stages, but ultimately replace those structures. A child who enters the concrete operational stage can no longer function at the preoperational stage. Adult growth, however, is not static achievement, but continual

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