Three developmental paradigms

The integrated nature of human activity finds its first expression in the labor process, the archetypal form of human activity. The two fundamental features of labor, which later become characteristic of human activity in general, are its mediated structure and its collective social organization. And these turn out to have important psychological implications. Human do not work on the world directly but through tools or instruments, using this term in the broad sense to include symbolic means. And since labor is performed in conditions of social organization, the individual functions in this process not only in a certain relationship with nature but also with outer people, members of a given society. The *individual, the world of objects*—and *society*—are unified in this construct of activity and together are constitutive of it. (p. 284)

Mind in action: A functional approach to thinking

By a practice, I refer to a socially-constructed activity organized around some common objects. A practice involves bounded knowledge domains and determinate technologies, including symbol systems. A practice is comprised of recurrent and interrelated goal-directed actions. Participants in a practice master its knowledge and technology and acquire the mental and manual skills needed to apply them to the accomplishment of actions goals. (p. 299)

What practices should be selected for initial studies? I chose work for reasons of significance and strategy. Significance is apparent. Just as play represents the dominant activity of preschoolers, and school a dominant activity for children and youth, work is a principal activity for adults. Work occupies the bulk of our time. We tend to identify ourselves through our work: you are a psychologist, she is a surgeon. Work offers us many occasions for acquiring knowledge and developing expertise. While we are certainly not wholly defined through our participation in society’s labor, it is unlikely we can fully understand the life cycle of development without examining what adults do when they work. (p. 299)

[me: yet school is also a workplace for many adults]

Knowledge at work

What we discovered in the dairy are the complexities of working knowledge—its dependence on forms of action and its regulation of forms of action. I the dairy, social knowledge is differentiated from, but not opposed to, individual knowledge. If social knowledge organizes the dairy—its physical environment and symbolic forms—individuals use this social knowledge creatively to shape work that is better adapted to human needs. We can only regret that our social institutions—industrial workplaces—are so organized as to limit the ways in which the thought and action of individual workers can turn back, enrich, and humanize social knowledge and practice. (p. 315)

Thinking in action: Some characteristics of practical thought

skilled practical thinking involves problem formation as well as problem solution and involves the dialectical constitution of problem and solution; is marked by flexibility (solving the same problem in different ways as cued by the setting), incorporates features of the task environment (people, things, information) into the problem-solving system such that the environment serves as part of the problem-solving system, seeks those modes of solution that are the most economical or require the least effort, and involves the acquisition and use of specific knowledge that is functionally important to the larger activities in which problem solving is embedded. (not a quote)

practical thinking . . . emphasizes the inextricability of task from environment, and the continual interplay between internal representations and operations and external reality throughout the course of the problem-solving process. (p. 330)

[me: the setting is constructed, and this construction is malleable as new events unfold with new factors.]

In a changing task environment, problems are often formally but not functionally the same. (p. 332) [me: e.g., teaching the same prep in different class periods]

Quote: Unlike formal problem solving, practical problem solving cannot be understood solely in terms of problem structures and mental representations. Practical problem solving is an open system that includes components lying outside the formal problem--objects and information in the environment and goals and interests of the problem solver. Expertise in practical thinking involves the accomplishment of a fitting relationship among these elements, an accomplishment aptly characterized as functionally adaptive. Beneath the surface of adaptation, however, lie continuing acts of creativity-the invention of new ways of handling old and new problems. Since creativity is a term ordinarily reserved for exceptional individuals and extraordinary accomplishments, recognizing it in the practical problem-solving activities of ordinary people introduces a new perspective from which to grasp the challenge of the ordinary. (p. 334-335)

Studying working intelligence

“practical thinking” refers to all thinking that is embedded in larger activities and that functions to carry out the goals of those activities. Goals may involve mental accomplishments (e.g., computing the cost of a milk delivery) as well as manual accomplishments (e.g., loading a truck). The phrase “working intelligence” thus has two senses: it refers both to the intellect at work in whatever contexts and activities those may be and, more narrowly, to the particular context of the dairy studies—the workplace. (p. 339)

Experience [is] the active engagement of an individual in some pursuit involving socially organized domains of knowledge and technologies, including symbol systems. It conceives of functionality in the instrumental sense of supporting accomplishment of some goal-directed action. (p. 341)

A plant [like a school] can be viewed for some purposes as analogous to a “culture.” Occupational activities are socially organized for socially defined objectives and make use of “culture-specific” knowledge domains and technologies. An industrial plant has the added feature, useful for research purposes, of making required tasks and norms of performance explicit, often in the form of official job descriptions. (p. 343)

[me: teachers’ work is becoming highly explicitly organized, yet not in every regard]

The factory as a research site substituted in some respects for the school, an institution that for years has been exploited for experimental studies. However, in one important respect the factory does not substitute for a school: its population is not captive for purposes of research. (p. 360) [me: originally published in 1984, probably written 2 or so years earlier; IRB was not as pervasive then, <http://www.lawandsociety.org/LSA_MPIC_Report.pdf>]

Problem solving is marked by variability, which is rule-governed yet fit to the occasion (Bartlett, 1958). Scribner says:

The variability we observed [in the dairy] was neither random nor arbitrary. It was sufficiently systematic to appear in analyses without benefit of statistical tests. Following Bartlett, we might consider these regularities as forms of adaptation. We can then put to future studies this proposition: skilled practical thinking is goal-directed and varies adaptively with the changing properties of problems and changing conditions in the task environment. In this respect, practical thinking contrasts with the kind of academic thinking exemplified in the use of a single algorithm to solve all problems of a given type. (p. 363)

Mental and manual work: An activity theory orientation

Literal solutions: when symbolic representation and mental/practical operations are isomorphic.

Nonliteral solutions: “They require mental work over and beyond those required by literal solutions.” (p. 370)

With extended practice many learners who begin with a literal functional organization adopt nonliteral modes of solution spontaneously and without instruction. The course of change is from literal to nonliteral solutions. Mental operations come to substitute for physical operations, not the other way around. . . . construction of nonliteral solutions is not an all-or-none affair but takes place in the form of a learning curve. (p. 371).

[me: i.e., it is developmental. How does this view fit with concept development? Is trial and error an efficient way of developing nonliteral solutions? Does a conceptual grounding reduce the number and variety of trials required for a solution to emerge?]

Of special significance to an activity analysis is the role of social factors in establishing a common interpretation of a preferred mode of task organization. We need a greater understanding of the ways in which the institutional setting, norms and values of the work group and, more broadly, cultural understandings of labor contribute to the reorganization of work tasks in a given community. (p. 373)

[me: i.e., intersubjectivity. SS’s research focused on collective work that is highly restrictive. Do the same principles adapt easily to student teaching, where the role of the mentor as an individual mediator plays such a singular and powerful role?]

Toward a model of practical thinking at work

Scribner details attributes of practical thinking at work in the dairy:

**Flexibility: Variation in modes of solution**

Flexibility most clearly distinguished experts from beginners. Novices tended to rely on algorithms which produced correct solutions through repeated application of a single solution procedure; with increasing experience, they replaced all-purpose algorithms with a repertoire of solution modes fitted to properties of specific problems in changing task environments. (p. 376)

**Fine-tuning to the environment**

Skilled problem-solving in the dairy was finely-tuned to the properties of the external, material environment and to changing conditions within it.

The ability to exploit (that is, effectively utilize) resources in the environment for problem-solving purposes distinguished experts from novices and often provided the basis for their solution versatility. (p. 377)

[me: in school, more experienced teachers may be more expert in one pedagogical tradition, such as authoritarian teaching; while novices (student teachers, beginners) may seek expertise in another tradition (progressive) that is poorly served by the established instructional contours.]

The environment was more than an external “context” in which problem-solving occurred; it was an integral component of the intellectual activity itself. (p. 378)

[me: cf. Cole on context’s etymology in “weaving.”]

**Economy: Effort-saving as an optimal solution strategy**

Skilled thinking on dairy tasks was regulated by a “least effort strategy” [which] refers to the psychological reorganization of work tasks to reduce the number of physical or mental steps required for their accomplishment and/or to simplify steps that cannot be eliminated; it has nothing to do with efficiency of movement or other industrial engineering concepts. (p. 378)

**Dependency on setting-specific knowledge**

Skilled problem-solving strategies in the dairy were dependent on specific knowledge about the things and activities in the workplace itself.

Most dairy tasks required a fund of “general knowledge”—background information of a worldly or academic kind, and some level of basic skills (numeracy, literacy). But the hallmark of expert problem-solving lay in the fact that the experienced worker was able to use specific dairy and job-related knowledge to generate flexible and economical solution procedures. Expert problem-solving procedures were content-infused, not content-free. (p. 379)

**Problem-solving at work: A summary description**

The movement of thought is two-way. In addition to going from problem to solution, thinking proceeds from “anticipated solution” to “construction of problem.” Steps to solution are variable and modified in kind and in order by fine-tuning to the environment; they do not invariably follow a fixed or “one-best” sequence for a given class of problems. (p. 380)

The novice enters the workplace with a stock of knowledge, some school-based and some experience-based, and with certain general problem-solving skills (e.g., mental rehearsal, means-end analysis). An important aspect of learning at work involves adapting this prior knowledge and these general skills to the accomplishment of the task at hand. Such adaptation proceeds by the individual’s assimilation of specific knowledge about the objects and symbols the setting affords, and the actions (including cognitive actions) that work tasks require. Domain-specific knowledge reveals relationships that can be used to shortcut those stipulated in all-purpose algorithms; with domain-specific knowledge workers have greater opportunity to free themselves from algorithms and to invent flexible solution procedures. What emerges through this process is a qualitatively different organization of problem-solving procedures from that initially brought to the job. Problem-solving skill in this model implies not only knowledge and know-how but creativity—an attribute of the work group as a social entity if not of each individual within it. . . . Without minimizing the abstract processes involved, it seems appropriate to describe the primary course of attainment of problem-solving skills at work as a process of “concretization.” Because of the relative neglect of this process in theory and research, and its educational implications, it warrants emphasis here. (p. 381)

[me: a key insight there. It suggests the need to rethink the notion of knowledge transfer, which tends to be characterized as a knowledge set that is originally learned, and then applied in new and seemingly different contexts. Perkins: Transfer of learning occurs when learning in one context or with one set of materials impacts on performance in another context or with other related materials. Perkins and Salomon argued that “high-road” transfer “depends on mindful abstraction from the context of learning or application and a deliberate search for connections: What is the general pattern? What is needed? What principles might apply? What is known that might help? Such transfer is not in general reflexive. It demands time for exploration and the investment of mental effort. It can easily accomplish far transfer, bridging between contexts as remote as arteries and electrical networks or strategies of chess play and politics. For instance, a person new to politics but familiar with chess might carry over the chess principle of control of the center, pondering what it would mean to control the *political* center.” <http://learnweb.harvard.edu/alps/thinking/docs/traencyn.htm>

[still me: Scribner seems more concerned with adapting knowledge than transferring it, and I think that conception is more in line with the idea of appropriation. Appropriation and adaptation suggest the constructive nature of knowledge development and application; transfer seems to suggest that people learn it wholesale here and apply it wholesale there. Even the mindful abstraction of high-road transfer seems to assume that the knowledge is there and mainly requires effortful application in new settings. So, in learning to teach, a novice will appropriate a concept and adapt it to circumstances through mindful abstraction. But both the concept (“whole language instruction,” “collaborative learning,” etc.) may be appropriated in ways inconsonant with what the source provides, and then reapplied in new contexts in ways that suggest a misreading of the setting (the kids are already acculturated to such new practices). Scribner’s dairy plant had far greater agreement on the product (milk bottled and packaged and sold and delivered, etc.) than do schools (standardized tests suggest one educational outcome, but various educators might believe in others). So any setting is amenable to multiple constructions, e.g., the mentor teacher may view kids as relatively worthless little beasts who need to be controlled with worksheets, while the student teacher may view the same kids as in need of other sorts of instructional support to help them reach their potential.]

Back to Scribner:

Thinking at work is fitted to the functional requirements and resources of particular tasks, and seems aptly characterized as adaptive. Because adaptation is a concept that emphasizes the fit of human thought and behavior to an existing environment, describing thinking at work as adaptive would seem to preclude its characterization as creative. The notion of creativity stresses the human production of something new. Yet thinking in the dairy was *both* adaptive *and* creative. Adaptation of thought to its functional requirements had an active, not passive character, and it proceeded on the basis of worker invention of new solutions and strategies. Invention is a hallmark of creativity and it played a major role in all the occupations studied in the dairy community. One might say that cognitive adaptation in the dairy occurred, not as a result of processes happening to the employees, but as a result of their continual creativity.

 Since creativity is a term ordinarily reserved for exceptional individuals and extraordinary accomplishments, recognizing it in the problem-solving activities of ordinary people at work introduces a new perspective from which to evaluate working intelligence. (pp. 381-2)

[me: So, to revise the account I attempted above, the adaptive process involves creativity. In the realm of education, creative teachers are typically constructed as those exceptional, often artistic types featured in Freedom Writers and other films: the person (often from outside the system) who reaches kids souls (Freedom Writers) or inspires them to do math better (Jaime Escalante), etc. Scribner’s observations about workplace creativity suggests near-continual creative adaptation to new conditions, even within a tightly-structured industry like dairy production. Schools are much more unpredictable; kids and milk bottles have different degrees of cooperation with adults at work (teachers). So those creative adaptations occur with greater frequency and have greater consequences (broken milk bottles don’t have parents who sue teachers for mistakes).]

Hand and hand: An action approach to thinking

Goal is a multi-sided concept. It cannot be entirely specified from a task analytic perspective since it has its subjective as well as objective aspects. (p. 395)

We are interested, not in whether *particulars* about practical skills generalize, but whether we can find *general* characteristics across a wide range of *particular* tasks. Our research offers some candidates for such characteristics, a number of them already exemplified in my description of product assembly. Common to expert performance in all jobs we have analyzed to date are a set of interrelated attributes: flexibility in modes of solution to formally identical problems, creative shortcuts to simplify and economize on mental and physical effort, fine-tuning to the environment, and effective utilization of setting-specific knowledge. (p. 397)