Literacy and Labeling
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The popular literature on workers’ abilities and the demands of work (cf. Hull, 1993, for a review) often provides accounts of the “skills-poor” worker: the carpenter who can’t read a ruler and makes mistakes in calculations; the machine operator who can’t decipher warnings posted about the factory and gets involved in serious accidents; the recent immigrant who is still learning English and “miscommunicates” when writing pass-downs for the next shift. The usual moral of these stories is that employers need to beware of workers’ skills deficits and assume responsibility for the literacy, language, and other instruction that people didn’t receive in school. Workers are likewise advised to retool, retrain, and remediate their deficiencies lest they lose their jobs and not be able to acquire new or comparable ones.

This month’s column is about a literacy problem in a workplace, a documented instance of workers in an electronics factory who apparently failed to read (or follow) written instructions and only narrowly avoided a costly production mistake. However, the moral of this story won’t be the standard warnings about a skills-poor workforce and the necessity of basic skills instruction for ever increasing numbers—though of course some workers do want and need to improve their language and literacy capabilities; this isn’t at issue. Rather, I will suggest that to be truly literate, sufficiently skilled, and knowledgeable, employees also need access to a wider range of information about companies and their work than we have typically assumed, and they need the opportunity to exercise their literacy capabilities. That is, work must be organized to allow, even to require, workers to take responsibility for reading and writing on the job (cf. this column, September and November 1998). One barrier that stands in the way of allowing and requiring front-line workers to be literate at work is an erroneous notion of what people are incapable of, a deficit way of thinking that has also been the bane of many remedial school programs.

The literacy problem
The following account is adapted from a longer report (Hull, Jury, Ziv, & Katz, 1996). All names are pseudonyms.

One evening during the second shift at a circuit board assembly factory in the Silicon Valley of northern California, I was “shadowing” a process engineer, Wade, in hopes of getting a sense of the literate requirements of this high tech workplace. Wade’s main project for the evening was sorting through a box of 35 or so printed circuit boards that had been returned to the factory by a customer for modifications or “rework” that would bring them up to current specifications. (This kind of task is common in circuit board assembly. Computer companies are continually improving
board design and expect the required updates to be done and documented quickly and accurately.) I watched Wade methodically examine and sort each board, jot down serial numbers, and write other notes. He later converted his scribbles to instructions for the front-line workers who would make the modifications on the boards.

During the next week my research team and I watched as workers carried out Wade’s instructions (see Figure 1) on a subset of the 35 boards, three especially complex “mother boards” that were designated “hot”; the oldest in the batch, these were the boards the customer wanted back pronto. We observed as one worker added a green wire as directed in the instructions. Another explained what she had done on the board, characterizing the rework as “straightforward.” This employee noted that the only remaining task was the addition of a datecode label, also explained in the instructions. Another worker set off to make these new labels.

We saw nothing that struck us as unusual during this process, but when Wade, the engineer, later checked on the progress of the boards as he had said he would, the fur flew. “See the little jumper wires I referred to on the instructions,” he had started to say approvingly as he showed me one of the completed boards. Then he paused and noted quietly, “We got a problem here though. The instruction says to make a datecode label of A, 33, 37.... Need to reject these.”

Jamal, the lead worker in the Test area, perhaps taken aback by Wade’s consternation, pointed to the rework instructions and said to Wade. “I think this is your instructions.” “I know,” Wade replied, “and they didn’t follow them.”

The problem wasn’t that the workers had repaired the boards incorrectly. In fact, as Wade would later point out, their handwork was so superb that the three boards were virtually identical, just as they should be. Rather, the problem was with the datecode label, a tiny identification that is affixed to every printed circuit board. (See Figure 2 for a replica of the actual label and Figure 3 for an enlargement and legend.) The parts of the label include the datecode (which indicates the version of the board—in this case “B”—and the week and year it was manufactured—in this case the 37th week of year 33, meaning 1993) and the serial number, the unique identification number for that particular board.

Wade’s instructions had directed the workers to first “Make new datecode label (A-3337)” and then “Apply new datecode label over old datecode on serial number label.” He further directed, “Do not cover old serial number or assembly number of the label” (see Figure 1). The workers’ mistake was threefold: They had removed and discarded the original label, they had generated a whole new datecode label with a new serial number, and they had changed the version number on this new label from A to B.

Upon discovering the mistake, the engineer hurried down to the shop floor to find out what had happened. He called to the lead worker in the “second operations” area:

Wade: Marisa! RSD made [a type of mother board]? Marisa: Yes.
Wade: RMA’s rework instructions for the boards?
Marisa: Right.
Wade: Did you make the stickers?
Marisa: The sti... yes.

**Figure 1**

Excerpt from instructions for board rework and datecode label replacement

<table>
<thead>
<tr>
<th>工序详情</th>
<th>代码说明</th>
</tr>
</thead>
<tbody>
<tr>
<td>对于序列号032仅有的，拆除位于位置Z3的二极管。</td>
<td>仅针对序列号032的，将二极管移除并移到位置Z3。</td>
</tr>
<tr>
<td>对于所有装配，执行以下工作。</td>
<td>适用于所有装配。</td>
</tr>
<tr>
<td>拆除IC位于位置U16（74HC244）。</td>
<td>将IC移除并移到位置U16（74HC244）。</td>
</tr>
<tr>
<td>焊接到位置U16的PA11引脚的1820-6307（74HC244）。</td>
<td>将1820-6307（74HC244）的PA11引脚焊接到位置U16。</td>
</tr>
<tr>
<td>将P19和U17的线缆提升。</td>
<td>将P19和U17的线缆提升。</td>
</tr>
<tr>
<td>将P11和U34的线缆提升并用护套保护。</td>
<td>将P11和U34的线缆提升并用护套保护。</td>
</tr>
<tr>
<td>将这些引脚使用#30 AWG绿色跳线电缆连接。</td>
<td>使用#30 AWG绿色跳线电缆将这些引脚连接。</td>
</tr>
<tr>
<td>将P1至U34的P11引脚提升。</td>
<td>将P1至U34的P11引脚提升。</td>
</tr>
<tr>
<td>将P10至U17的P19引脚提升。</td>
<td>将P10至U17的P19引脚提升。</td>
</tr>
<tr>
<td>将PAC WIREFS EVERY 1/2 INCH。</td>
<td>将PAC WIREFS EVERY 1/2 INCH。</td>
</tr>
<tr>
<td>手工作区清洁。</td>
<td>执行手工作区清洁。</td>
</tr>
<tr>
<td>拆除M9修订版的BIOS IC位于位置U22。</td>
<td>将M9修订版的BIOS IC移除并移到位置U22。</td>
</tr>
<tr>
<td>安装M9修订版的BIOS IC位于位置U22。</td>
<td>安装M9修订版的BIOS IC位于位置U22。</td>
</tr>
<tr>
<td>生成新的日期代码标签（A-3337）。</td>
<td>生成新的日期代码标签（A-3337）。</td>
</tr>
<tr>
<td>在旧日期代码标签上的新日期代码标签。</td>
<td>在旧日期代码标签上的新日期代码标签。</td>
</tr>
<tr>
<td>不要覆盖旧的序列号或组装编号的标签。</td>
<td>不要覆盖旧的序列号或组装编号的标签。</td>
</tr>
<tr>
<td>使用SPND ASSFMILIES进行测试。</td>
<td>使用SPND ASSFMILIES进行测试。</td>
</tr>
<tr>
<td>执行ICT测试的，如果可能和功能正常。记录调试时间。</td>
<td>执行ICT测试的，如果可能和功能正常。记录调试时间。</td>
</tr>
<tr>
<td>进行任何回拆操作的测试。</td>
<td>进行任何回拆操作的测试。</td>
</tr>
</tbody>
</table>

**New Workplaces and Literacies**
Wade: Day shift? Porqué no A? How come there’s no serial number? What did you do with the old serial number? Did you just put new serial number for everything? Why did you...

Marisa: I don’t touch those. Who was the person?

Visibly alarmed, Marisa went to seek reinforcements from among the operators who worked on the three boards, and they spoke together for a moment, but nothing seemed to be resolved.

At this point I was still mystified by the degree of consternation that accompanied the label problem, for surely, I thought, the labels could simply be reproduced and the error corrected. But this was not the case. As Wade explained several times over the course of the next half hour. “Now we’ve lost traceability on these boards. Basically I don’t know how I can identify them now.” The concept of “traceability” was central to this company’s successful dealings with its customers. As a contract manufacturer, the company needed to keep exact records on all its products, including recurring updates and modifications, and the record keeping applied to individual boards as well as to types of products.

In this case, the three mother boards had been taken out of particular systems, and the customer expected to replace each board accordingly. It is significant, and I will return to this point later, that “traceability” is inexorably linked to literacy and can be considered a literate practice that some employees share and understand, and that others don’t—despite the fact that it has implications for the work of all.

Operator brain dead

In addition to trying to understand the significance of the mistake, I was interested in why it had happened, especially since the error was apparently connected to workers’ failure to read, understand, or follow written instructions. It seemed to be a quintessential example of the widespread fears mentioned at the beginning of this column. Thus, the day after the mistake was discovered, my colleagues and I interviewed employees up and down the plant hierarchy, including the operator who applied the incorrect labels, in an effort to discover the likely causes of the error.

When Wade was asked how he thought the mistake had happened exactly, he responded as follows:

Wade: Probably related to another acronym we have here, “OBD.”

Researcher: I hesitate to ask.

Wade: It stands for “operator brain dead.”

Researcher: Uh-huh.

Wade: Occasionally we run into that, not too often.

Wade’s explanation was simple inattention.

Other people in the factory blamed the problem on the fact that this was a largely immigrant, largely Korean workforce. The perception was that most of the Korean workers and many of the other immigrants could not speak, understand, read, or write English, and that furthermore they weren’t all that interested in learning. “What could help us here,” said one manager, “is an intense ESL program. The Koreans would resist that my impression none of ‘em ever said that. I just have this feeling they wouldn’t be receptive.”

The workers’ immediate supervisor pointed to a “shift problem.” She believed the employees read the instructions too quickly to notice what was salient, and that they did so because they were mistakenly in a rush to finish the boards and move them to another department by the end of their shift, an analysis she believed was erroneous: “They feel like it’s a shift type of thing. They need to produce enough assemblies. Whatever they touch and work on, they need to move it on. It’s a quota type thing. It isn’t.”

All of these accounts by engineers, managers, and supervisors locate the source of the problem with the workers—in their lack of skill, or language, or motivation, or their erroneous perceptions. Let us turn, finally, to see what can be learned from the workers themselves.

Marisa, the lead worker in the hardware department, is the person who made the incorrect labels and passed them to another worker, Tran, to be affixed to the boards. Marisa’s explanation for her error had to do in part with how work was organized on the shop floor, especially the literacy requirements of work. It seems that one employee in Marisa’s department, Mrs. Kim, always read the entire set of instructions for each board and let people know if anything special was required. On the day the three mother boards were reworked, Mrs. Kim was absent, and the person who took over her job did not act as the literacy broker for the rest of the workers. “She just read her part,” Marisa complained. “Mrs. Kim always reads the whole thing and then she tells you.” Not alerted to the special directions, Marisa made new labels according to the customary process.

Interestingly, if Marisa had read the instructions herself, she would certainly have known what to do in a procedural sense—to leave the old datecode label on the board, to prepare a new, smaller label with a new month and year, and to paste it on top of the old one. However, as
will be clear from the following interview excerpt, she would not have understood the role and importance of such documentation in the all important practice of maintaining traceability:

Researcher: Do you have to understand what the numbers on the label mean?
Marisa: Yes, this is the datecode. We’re supposed to leave old label. Customer wants to change new datecode. I make small label with datecode and cut it and put it on top of the other one.
Researcher: Why is that so important to the customer?
Marisa: We’re not supposed to remove the old label. That one, we’re supposed to leave it on there.
Researcher: Do you understand why they care that much about whether the old label’s there?
Marisa: Uhhmm, not really, but we just have to follow what the customer wants. If he, they say “I want you guys to remove that label,” we just want to leave it alone, just change datecode.
Researcher: Do you understand why it’s such a big deal?
Marisa: I not really understand that.

It is noteworthy that workers like Marisa were expected to read and follow directions, but not to understand their significance. This suggests another reason for the labeling error—not having access to global knowledge about the manufacturing process that makes tasks understandable, meaningful. If Marisa had understood the relationship between labels and traceability, and if she had understood the role of traceability in contract manufacturing, she might have paid more attention to instructions to make particular datecode labels.

The last worker my research team interviewed about the hoard problem was Tran, the person who had pasted Marisa’s incorrect labels on the board. His explanation for his part in the mistake was simple—reading directions was not part of his job:

Tran: Only the lead take care.
Researcher: Only the lead takes care?
Tran: When I’m not lead, I’m not looking.
Researcher: Not looking at the MPP [Manufacturing Process Instructions]
Tran: Yeah. Only the lead take care.
Researcher: Did anybody ever show you how to read the MPP?
Tran: No, they didn’t show.

Tran recognized what we had learned from the managers early on in our study. This company’s policy was that only the lead workers for each line or area (workers who assumed more responsibility but received no additional pay) were responsible for reading written instructions; these leads were then supposed to spread the word orally. As we saw with Marisa, sometimes the workers devised a system whereby someone besides the lead acted as a literacy broker. But the official policy—which originated in large part as an attempt to compensate for what were perceived to be ESL problems—was that only the leads were required to read. Thus, Tran, who could read English and who could have read Wade’s rework instructions, didn’t feel compelled to do so and couldn’t be completely blamed for his choice, given the factory’s policy on literacy responsibilities.

Beyond deficit thinking
This story of a literacy problem suggests that it may indeed matter, and matter a great deal, when work is organized such that front-line workers aren’t expected to read. Not only should front-line workers be expected to read, but they should also possess greater knowledge of a factory’s operation and the industry’s practices if they are to interpret accurately what they will need to read. Thus, being fully literate in such a manufacturing environment goes beyond being able to decode instructions on how to apply a datecode label. It includes global knowledge of the industry—such as understanding the important practice of traceability.

The label problem further illustrates how erroneous beliefs about ability, beliefs that can quickly grow...
from ethnic or class bias, can have a harmful influence on work organization and work relationships. We recall the manager who believed that the Korean workers would resist ESL instruction. The following is a more blatant statement that such workers are different and "lesser." It is an assessment by a personnel supervisor who characterized the largely immigrant workforce of the factory in opposition to the factory's largely white management.

Yeah, well, see, most of those people are, have only been in this country less than 10 years. So most of those people are your craft kind of people, your general assembly labor, and that's about all that they want to be.... 'Cuz you figure, you, 'cuz you know, we have like two classes. We have our worker/assembly people and then we have like our supervisor/manager/engineering kind of people, and it's, it's, there's really like two ends of the scale. We've got people that almost can't communicate, and you have people on the other end with like degrees.

Such a dichotomy, a great divide that generally separates labor and management aided by the absence of respect on either side to bridge it, is no doubt familiar to anyone who has spent much time in factories. Feeding this division is a long-standing tendency on the part of many in our society as well as throughout history to view skeptically the abilities of people who labor physically, "sentiently" rather than "intellectively" (cf. Zuboff, 1988).

Considering working people—those the personnel supervisor designated "your craft kind of people"—as somehow lesser in ability and potential is wrongheaded in various ways. To slide too quickly to labels like "OBM" as explanations for literacy-related or other errors—to form stereotypes based on the intersection of ethnicity, class, gender, and company hierarchy—is to obscure explanations that may be closer to the mark and that may improve company function as well as more justly represent workers' abilities and potential. To resort to such labeling also mischaracterizes the kind of support that workers need to improve their performance and eliminate the errors that so vex their supervisors, engineers, and managers.

A complex web of contextual factors combined to create the conditions under which the labeling mistake could happen. There was, at root, the mistrust that permeated managers' thinking concerning their largely immigrant workforce. The managers perceived that workers had ESL problems and lacked desire to learn English. This perception (which was erroneous—many workers were enrolled in ESL classes outside of work) influenced the very organization of work. Company policy was that only workers (one designated person per area) needed to read the important manufacturing process instructions, despite the preponderance of documentation and its importance to company relationships with customers and international certification agencies.

Similarly, and just as significantly, front-line workers weren't expected to have certain kinds of knowledge about the company's function as a contract manufacturer. While talk about "traceability" was common among higher-ups in the company, as was an understanding of the role of literacy in this process (including the simple but essential literate practice of affixing datecode labels), front-line workers like Marisa did not share in this knowledge.

I would suggest that this company's mistrust of its immigrant workers' language and literacy abilities, coupled with the conflicting pressures of a contract manufacturer to produce at high quality and in high volume, resulted in inadequate language and literacy policies and practices. These took away from most front-line workers the responsibility to read manufacturing process instructions as well as the perceived need, the opportunity, and the desire to do so. Being literate in English and being an English-speaking employee was not part of the work identity of many employees.

In schooling and at work, this story leads me to ask: How might we move beyond a simple assumption of deficiency and the tendency to label and mislabel individuals and groups? And how might we move toward a persistent belief in human potential and a broader based explanation for error, one that takes into account the institutional, political, and sociocultural contexts in which a person reads and writes? Such a perspective could help us to distinguish literacy problems that have to do with failing to read labels from structural, economic, and racial issues that have to do with mislabeling people.

REFERENCES