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The Besieged Workplace: How Cognitive Science Can Respond

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Workcenters in the public and private sectors are being invaded by complex, dynamic equipment systems. Global competitiveness and diminished budgets in turn dictate a downsized, but **adaptive** workforce. In this study, innovative data gathering that informed an uncommon instructional system offer a response from cognitive science to the besieged workcenters. Cognitive task analysis methods captured the components of troubleshooting expertise from dozens of Air Force master technicians as they worked on authentic fault scenarios. The codified output and developed scenarios then provided input to an intelligent tutoring system called Sherlock. This tutor targets high-difficulty F15 avionics troubleshooting skills. In a controlled experiment, 41 apprentice and journeyman airmen were pretested on their troubleshooting competence and then randomly assigned to two equivalent groups. The experimental group worked on the tutor 1-1/2 to 2 hours a day over an average of 7 days. The control group continued their standard on-the-job training regimen, working with senior team leaders in the shop during those hours. After the intervention, on both verbal protocol and paper and pencil posttests used to assess troubleshooting performance, the experimental group out-performed the controls ($p = .001$; $p = .009$). Results held up for 6 months after the tutor was removed. (Finding from evaluation of Sherlock prototype.) Also, in the present evaluation, subjects were required to troubleshoot a completely novel equipment system. Again, the experimental group prevailed on both measures ($p = .006$; $p = .025$). The implications of this work are as follows: purposeful learning experiences in systems where knowledge connects with its uses in the world appear to accelerate the development of adaptive, "Information Age" expertise. Innovative communities of practice should not be far behind.