

Supporting collaborative learning in work practice transformation

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Research problem

Numerous studies of work in process industry has been conducted, describing the nature of process operator work and consequences of automation. In general, process control automation makes operator knowledge more abstract and can potentially hamper development of the operators ability to handle emergency situations. In this research project the nature of change in work practices caused by automation at a chemical industry is studied, and possibilities for overcoming negative effects of automation with computer-supported collaborative workplace learning are explored. A computer support for collaborative workplace learning is being developed and studied in use. In particular the evaluation will focus on how it can support collaborative reconstruction of operator work practice, and dissemination of work knowledge within and across work shifts.

Research site

The study is carried out at a division of a large chemical industry in Sweden producing liquid chemical products, where a computer-based process control system is being implemented. In emergency situations (e.g. power failure or loss of air pressure) the process operators switch to manual operation to bring running processes to a stable state, and

failure in doing so can result in severe environmental and material damage. The manual work has earlier been characterized by craftlike skills, and learning through apprenticeship.

From preliminary observations and interviews with 11 of the 14 operators it seems clear that automating process control at the Chemitech factory will substantially change the preconditions for developing abilities to handle emergency situations, and these abilities may slowly erode in the long run. Most operators perceive a need for improving their abilities to handle emergencies, and in particular situations demanding manual operation. This include better knowledge of appropriate actions as well as a better sense of orientation in the manual control system. Also, the observations and interviews have revealed that operator knowledge is largely collective and heterogeneous. In problem situations operators often rely on experience from other workers on the shift, and problems are often solved in collaboration within the shift. In reconstructing operator work practice it becomes important to bring together the experience from the different shifts to develop the best work practice under the new working conditions. The reconstruction is therefore a collaborative process where each operators' individual experience is brought into play.

Computer support for collaborative reconstruction of work practice

A computerbased tool is developed in close cooperation with three operators with the aim of supporting operators in re-establishing the connection to the physical production environment by improving understanding of the relation between the displayed process representations and the production system, developing a sense of orientation in the factory environment, and develop better knowledge of manual operations. The tool allows operators to co-construct an interactive hypermedia model of the physical production environment, including controls for manual operation. By describing current status for a number of reactor systems, problem situations based on real or invented cases can also be modelled by the operators for later simulation. Annotations describing e.g. known equipment problems can be linked to production machinery in the model, and a search facility for the annotations is provided. Finally, nodes in the hypermedia model can further be linked to intranet web pages for access to detailed documentation of machinery, or documented procedures for handling known recurring problems.

When the hypermedia model is constructed, problem situations can be randomly selected and simulated as a basis for training, discussion and reflection on improvements in work practice. The current production situation can also be extracted from the production management database system, and imported into the tool for a simulation of an emergency situation. A first model of the production environment and

problem situations based on real events, will be developed in collaboration between operators in scheduled weekly meetings with the different shifts over a initial period of 3 months. Operators across the works shifts will then continually work with adding new documentation and problem situations, as common problems are discovered and experience develops, and also to keep the model up to date with production environment changes.