Training operators in Micro-World simulations

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Abstract

Highly complex simulations of work environments allow controllable, repeatable experiments, while retaining the opacity and dynamic events that occur in real world situations. However, such tasks require considerable training to ensure the high levels of skill assumed by their use as analogues of real world tasks. We studied the acquisition of operator skill in using AUTOCAMS, a process control task based on a cabin air management system, using a training programme that emphasised both knowledge-based and rule-based instruction, and both practical and knowledge-based assessments of task skill. The results showed evidence of differential acquisition rates for procedural skill and both rule- and system-based knowledge, with slower learning for system knowledge than for the other two components. The findings have implications for training of operators in complex micro-world simulations.

Introduction

There can be little doubt that extensive practice on a complex task is critical for dealing with system disturbances. However, there is some uncertainty about what should be practiced. The traditional practice specificity argument suggests that training will be more effective under conditions that mimic real-world situations, whilst other studies have found that practising a number of different task variations results in better generalisation over task conditions (e.g., Schmidt, 1975; Hall & Magill, 1995), because of the development of (more flexible) schema or mental models. A separate issue relates to the separation of procedural skills (task performance) and task knowledge, or implicit and explicit learning (e.g., Berry & Broadbent, 1988), typically accompanied by differential acquisition rates (Rasmussen, 1983).

Our approach was informed by Rasmussen's (1983) classification of operator behaviour during the control of complex systems; skill-based behaviour (SBB), based on automated responses to highly familiar events; rule-based behaviour (RBB), associated with diagnosing routine situations where routine procedures are available; and knowledge-based behaviour (KBB), where high level reasoning must be used to deal with unfamiliar problems, or those where there are no existing procedures. To study acquisition patterns we trained participants on autoCAMS, a semi-automatic complex process control simulation (e.g., Sauer et al., 2000). Using

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