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Expert knowledge elicitation in the firefighting domain and the implications for training novices

Expert
knowledge
elicitation

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Abstract

Background/Purpose – Experienced firefighters often make important decisions in fast-paced fire ground environments characterised by uncertainty and evolving conditions, mostly under considerable time-pressure. The nature of these environments inadvertently presents firefighters with novel situations that occasionally challenge their expertise, subsequently necessitating a reliance on intuitive as opposed to rational decisions. The purpose of this study is to elicit the tacitly held knowledge and intuitive thought processes that were used by 31 experts while managing a range of complex, non-routine fire incidents.

Design/Methodology/Approach – The study used a formal knowledge elicitation technique known as the critical decision method (CDM). CDM is a qualitative strategy that applies a set of cognitive probes to explore the cognitive processes that aid the performance of a complex task. This method was preferred to other cognitive task analysis methods as it specifically favours the use of retrospective incident accounts and incidents that were both challenging and memorable. Using the full CDM protocol, 31 experienced firefighters were interviewed across various fire stations in the UK and Nigeria (UK = 15, Nigeria = 16). The interview transcripts were coded, categorised and analysed using the emergent themes analysis approach.

Findings – The results from the study identified 134 decision points across the 31 incident accounts. A total of 42 salient cues sought by experts at each decision point were revealed and organised into a critical cue inventory. The identified cues were subsequently categorised into five distinct types based on the type of information each cue relayed to an incident commander. The study further developed a decision-making model – information filtering and intuitive decision-making model – that describes how experienced firefighters made difficult fire ground decisions amidst multiple informational sources. The model ultimately showed experts' preferences for intuitive decisions as the default-thinking mode, with deliberation only required on few instances as conditions warranted. The study also compiled and indexed the cognitive strategies elicited from the expert firefighters into a competence assessment framework.

Practical Implications – In light of existing debate about the accessibility of expert knowledge, the current study not only provides empirical evidence detailing the practical application of the CDM as a formal knowledge elicitation method but also delineates a range of cognitive outputs from the elicitation process that ultimately holds relevance for knowledge transfer from expert to novices. The study identified a range of training needs and discussed the practical implications of transferring expert knowledge into learning tasks that could subsequently aid the cognitive development of novices. In particular, the study proposed adopting the four-component instructional design model in organising the CDM outputs for training purposes.

Originality/Value – While it is generally taken that experts, because of their extensive domain knowledge and well-developed schema, often perform considerably (and sometimes exceptionally) well when solving complex problems, finding a credible and objective method to model what experts know and do continues to pose a challenge, particularly when such revelation is crucially required for training purposes. This study is therefore timely since its tacit and intuitive knowledge outputs can



now be applied to enhance the development of training curricula for novices. The learning tasks developed from the CDM outputs are hoped to facilitate organisational learning not only within the firefighting domain but also across other high reliability organisations. It is extremely important that expert knowledge is preserved in these domains especially in countries such as the UK, where the rate of real fires has been on decline, which in turn suggests that the quality of experiential knowledge required to manage complex non-routine fire cases may also be on decline. The current study also presents and discusses insights based on the cultural differences observed between the UK and the Nigerian fire services.