Identification of Training Topics for the Improvement of the Relevant Cognitive Skills of Technical Operators in the Railway Domain

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Background of the study:

- Technical Operators (railway):
  Supervision and management of
  - railway power grid
  - railway tunnels
Background of the study:

- Technical Operators (railway):
  - Supervision and management of railway power grid
  - Railway tunnels
- Highly automated technical systems
- Checklists

Theoretical Background

Deskilling

(Manzey, 2012)
Goals of the study

1. Identify the **cognitive skills** relevant for the execution of the job
2. Define which **topics** should be addressed by the **training** of these skills

Qualitative design

*Observational Interviews*

*Cognitive Task Analysis*

(Ulich, 2011)  (Stanton et al., 2017)
Most demanding tasks identification:

- Managing the railway *power grid*
- Managing the railway *tunnels*
  - Managing malfunctions
  - ... (omitted)
  - Managing tunnel ventilation
  - ... (omitted)

  - Localizing malfunctions in the railway power grid
  - Managing manually the tunnel ventilation

Qualitative design

Cognitive Task Analysis

(Stanton et al., 2017)
Cognitive Task Analysis (CTA):

Perception

Comprehension and anticipation

Decision-making and performance of action

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Cognitive Task Analysis (CTA):

**Perception**

How must essential information for the execution of this task be perceived?

Communicating with other persons to find information that is missing in the technical system

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Cognitive Task Analysis (CTA):

**Comprehension and anticipation**

How can an essential information for the execution of this task be understood?

Communicating with other railway organizations to have a better understanding of the situation
Cognitive Task Analysis (CTA):

- Perception
- Comprehension and anticipation
- Decision-making and performance of action
- Development and implementation of tricks
- Self-monitoring
- Improvisation
- Knowledge of equipment’s limits
- Usage of tools

Qualitative design
Training topics definition:

Communication

- Communicating with other persons to find information that is missing in the technical system
- Communicating with other railway organizations to have a better understanding of the situation

Training topics definition:

- Building mental models
- Communication
- Teamwork
- Practical exercise
- Interaction with technology
- Stress management
Qualitative design

Training goals formulation:

- **Knowledge**: Knowing how to avoid misunderstandings
- **Skills**: Being able to communicate effectively
- **Attitude**: Being convinced that good communication is important
**Training topics definition:**

- Building mental models
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**Implications**

- Cognitive skills needed to
  - understand the job
  - master the most demanding tasks
  - adapt to varying conditions and appropriately react to unexpected events
- Training topics with specific goals
  - Development of specific trainings
  - Application in other highly automated domains
References: