Generic Error Modelling System (GEMS)

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HP Activity Categories:
Identification of potential human error and assessment of human error [1]

Resource Type:
Method

Abstract:

GEMS is an error classification method that is designed to provide insight as to why an operator may move between skill-based or automatic rule based behaviour and rule or knowledge-based diagnosis. Errors are categorised as slips/lapses (frequently skill-based errors) and mistakes (usually knowledge based errors). The result of GEMS is a taxonomy of error types that can be used to identify cognitive determinants in error sensitive environments. GEMS relies on the analyst either having insight to the tasks under scrutiny or the collaboration of a subject matter expert, and an appreciation of the psychological determinants of error.

References

Developer and source:


Year of development / publication, updates etc:

1990

General Description

Purpose:

GEMS is an error classification scheme developed by Reason that focuses on cognitive factors in human error as opposed to environmental or other context-related factors. GEMS is based heavily on Rasmussen?s three major categories of errors: skill-based slips and lapses, rule-based mistakes, and knowledge-based mistakes (SRK). GEMS is a more general description of the cognitive ?black box?, which can be used to address the mechanisms of both slips and mistakes. GEMS taxonomy of error types is a useful method to assess cognitive determinants in complex technological environments.

Type (e.g. observation, questionnaire, interview, checklist, measurement instrument, etc.):
Technical description of method or tool etc

Description of the content/study:

GEMS integrates in the same framework the different error mechanisms (slips, lapses and mistakes) and the three level of performances (SRK). The integration of these two dimensions allows to:

1. Gain a deeper understanding the nature of mistakes: Indeed, we can distinguish between rule-based mistakes and knowledge-based mistakes
2. Appreciate the details of the differences among error types
3. Appreciate how errors are the other side of the coin of the cognitive processes that allow us to act quickly or find creative solutions.
4. Anticipate when and in what conditions a certain type of error may occur.

GEMS and errors

Errors can occur at each level:

- skill-based: slips and lapses (usually errors of inattention or misplaced attention);
- rule-based: mistakes (usually a result of picking an inappropriate rule) caused by misconstrued view of state, over-zealous pattern matching, frequency gambling, deficient rules ;
- knowledge-based: mistakes (due to incomplete/inaccurate understanding of system, confirmation bias, overconfidence, cognitive strain).

Each error type is distinguished according to five factors: (a) the type of activity being performed at the time the error is made, (e.g. routine or non-routine); (b) the primary mode of cognitive control, (attention or unconscious processing); (c) focus of attention (on a task or activity); (d) the dominant error form (strong habit intrusions or variable); and (e) the ease with which the error can be detected and corrected (easy or difficult).

Technical requirements for using the method, tool, etc:

n/a

Measure/Response Type:

n/a

Results obtained and interpretation:

n/a

Evaluation

Advantages:

Ease of error detection, correction, and mitigation measures

Disadvantages:
Alternative Methods:

CREAM ? Cognitive Reliability Error Analysis (Hollnagel 1998);
HEART- Human Error Assessment and Reduction Technique (Williams 1986);
HEIST ? Human Error Identification in Systems Tool (Kirwan 1994);
HET ? Human Error Template (Marshall et al 2003);
HAZOP ? Hazard and Operability Analysis - Human Error Guidewords (Whalley 1988);
SHERPA ? Systematic Human Error Reduction and Prediction Approach (Embrey 1986);
SPEAR ? System for Predictive Error Analysis and Reduction (CCPS 1993);
TAFEI - Task Analysis for Error Identification (Baber & Stanton 1996);
THEA ? Technique for Human Error Assessment (Pocock et al 2000);
The HERA Framework (Kirwan 1998a, 1998b) ;
TRACEr - Technique for Retrospective and Predictive Analysis of Cognitive Errors in ATM (Shorrock & Kirwan 2000).

Usability (ease of use, efficiency, effectiveness)

GEMS is particularly easy to use and is adopted as efficient and effective method

Ease of use:
high
Efficiency:
high
Effectiveness:
high
Constraints concerning conditions of use:

GEMS is best suited and should be filled in immediately after each working session

Reliability:

High Reliability and validity

Required effort (to conduct & to analyse):

n/a

Level of HF expertise needed (required user qualification)
Analyst and Investigator expertise

High: high level of expertise required, only for experts, lots of training required
Other expertise needed (required user qualification):

n/a

Cost Information

not available

Experiences of use by SESAR partners (including references):

n/a

Reported and/or published experiences of use (including references):

n/a

Applicability to lifecycle phase (E-OCVM):

V2/V3 ? V6 (In this phase the actual benefits can be measured and compared with the expectations and predictions from the validation process)

Application Area:

Aviation, Transport, Pharmacy and Health care field.

Keywords:

<p>Generic error model</p>

Short Description:

GEMS is an error classification scheme developed by James Reason that focuses on cognitive factors in human error as opposed to environmental or other context-related factors. The result of GEMS is a taxonomy of error types that can be used to identify cognitive determinants in error sensitive environments.

Source URL: http://webprisme.cfmu.eurocontrol.int/ehp/?q=node/1593

Links