MASTER

A multimethod system for the assessment and training of teamwork in simulated scenarios

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PROJECT’S OUTLINE

• Simulation-based training in the electric industry

• Non-Technical skills (NTS) behavioural markers

• Non-verbal cues (NVC) monitoring
Situated Professional Skills

OPERATIVE Skills

COGNITIVE Skills

SOCIAL Skills
MAIN USE OF SIMULATION CENTERS

Training for apprentices and evaluation of performance
AN INTEGRATED METHODOLOGY FOR SIMULATION CENTERS

Recurrent training for workers’ Situated Professional Skills
AN INTEGRATED METHODOLOGY FOR SIMULATION CENTERS

attitudes → behaviour

metacognition

project
THE PROJECT

Definition of workers’ SPS profile → Development of simulation scenarios → Development of Non-verbal cues (NVC) tracking system → Simulation sessions → Definition of NVC relevant for safe performance

Outline of a global assessment tool
SPS profile

1. Knowledge of expected conditions
2. Observation of real conditions
3. Understanding real conditions
4. Implementation of safe-working conditions
5. Third-Party communication
6. Maintaining attention despite disturbances
7. Team communication/collaboration
8. Documentation usage
9. Stopping the work due to possible fraud
10. Stopping the work due to unsafe conditions
SPS checklist with behavioural markers

**PROJECT**

- Implementation of safe-working conditions
  - **Risk assessment**
    - Starts the activity before the due safety check (e.g., metal items test, devices functioning, etc.)
    - Starts the activity after having checked just some items
    - Starts the activity after a complete safety check (e.g., metal items test, devices functioning, etc.)

- Definition of workers' SPS profile
- Development of simulation scenarios
- Development of Non-verbal cues (NVC) tracking system
- Simulation sessions
- Definition of NVC relevant for safe performance

Focus groups with subject matter experts

SPS profile

SPS checklist with behavioural markers
PROJECT

Scenario

draft

Simulation

Assessment

Definition of workers’ SPS profile

Development of simulation scenarios

Development of Non-verbal cues (NVC) tracking system

Simulation sessions

Definition of NVC relevant for safe performance

Scenario 1C - Il contatore Reale

3rd edition
SCENARIO SCRIPT

Task Assigned

General Scenario Description

Overall Learning Objectives

SPS

Operational Context

Materials

Setting Set-up

Participants

Scenario Saving Items

Expected Duration

Detailed Sequential Description Of Scenario
### LIST OF SCENARIOS

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Title</th>
<th>Workers</th>
<th>Task</th>
<th>Overall Learning Objective(s)</th>
<th>Physical Risk Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1C</td>
<td>The Real Electricity Meter</td>
<td>1</td>
<td>EM with EM substitution (Electricity Meter)</td>
<td>Potential risks management</td>
<td>Electric, Low-Dexterity Injuries</td>
</tr>
<tr>
<td>2C</td>
<td>The Construction Site</td>
<td>2</td>
<td>Temporary supply installation</td>
<td>Securing the work environment</td>
<td>Electric, Fall, Low-Dexterity Injuries</td>
</tr>
<tr>
<td>3C</td>
<td>Demolition</td>
<td>1</td>
<td>Supply cessation and CE removal</td>
<td>Fraud identification</td>
<td>Electric, Low-Dexterity Injuries</td>
</tr>
<tr>
<td>4C</td>
<td>End Of Works</td>
<td>2</td>
<td>Temporary supply removal</td>
<td>SWP application</td>
<td>Electric, Fall, Low-Dexterity Injuries</td>
</tr>
<tr>
<td>5C</td>
<td>The New Three-phase</td>
<td>1(+1)</td>
<td>Three-phase EM with three-phase EM substitution</td>
<td>SWP application</td>
<td>Electric, Low-Dexterity Injuries</td>
</tr>
</tbody>
</table>
## Relationship Between SPS, Scenarios, and Checklist

| SPSs                                | 1C | 2C | 3C | 4C | 5C | TM01 | TM02 | TM03 | TM04 | TM05 | TM06 | TM07 | CM01 | CM02 | CM03 | TW01 | TW02 | TW03 | TW04 | TW05 | TW06 | TW07 | TW08 | TW09 | TW10 | TW11 |
|-------------------------------------|----|----|----|----|----|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 1. Knowledge of expected conditions | X  | X  | X  | X  | X  | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    |
| 2. Observation of real conditions   | X  | X  | X  | X  | X  | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    |
| 3. Understanding real conditions    | X  | X  | X  | X  | X  | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    |
| 4. Implementation of safe-working conditions | X  | X  | X  | X  | X  | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    |
| 5. Third-Party communication        | X  | X  | X  | X  | X  | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    |
| 6. Maintaining attention despite disturbances | X  | X  | X  | X  | X  | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    |
| 7. Team communication/collaboration | X  | X  | X  | X  | X  | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    |
| 8. Documentation usage              | X  | X  | X  | X  | X  | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    |
| 9. Stopping the work due to possible fraud | X  | X  | X  | X  | X  | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    |
| 10. Stopping the work due to unsafe conditions | X  | X  | X  | X  | X  | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    | X    |
Scenario 1C: The Real Electricity Meter

**Objective**: Change EM despite perturbations

**Environment**

**Context**
### Scenario 1C: The Real Electricity Meter

<table>
<thead>
<tr>
<th>Action/behaviour</th>
<th>Disturbance</th>
<th>SPS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prepares tools and materials</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Controls the environment</td>
<td>Label OUT OF ORDER</td>
<td>2 - 5 - 6</td>
</tr>
<tr>
<td></td>
<td>Client</td>
<td></td>
</tr>
<tr>
<td>Wears personal protective equipment</td>
<td>Client</td>
<td>1 - 4 - 5 - 6</td>
</tr>
<tr>
<td>Correctly finds the EM</td>
<td>N° of meter different from documentation</td>
<td>2 - 3 - 5 - 6</td>
</tr>
<tr>
<td></td>
<td>Display not working</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Client</td>
<td></td>
</tr>
<tr>
<td>Disconnects the EM</td>
<td>Client</td>
<td>3 - 4 - 5 - 6</td>
</tr>
<tr>
<td>Verifies absence of power outwards</td>
<td>Client</td>
<td>2 - 4 - 5 - 6</td>
</tr>
<tr>
<td>Disconnects, identifies, and isolates the cables</td>
<td>Client's cables of the same color</td>
<td>2 - 4 - 5 - 6</td>
</tr>
<tr>
<td></td>
<td>Client</td>
<td></td>
</tr>
<tr>
<td>Removes the old EM</td>
<td>Client tries to help</td>
<td>5 - 6</td>
</tr>
<tr>
<td>Installs and programs the new EM</td>
<td>Client's cables of the same color</td>
<td>3 - 5 - 6</td>
</tr>
<tr>
<td></td>
<td>Client</td>
<td></td>
</tr>
<tr>
<td>Correct ending of the EM change procedure</td>
<td>END OF SCENARIO</td>
<td></td>
</tr>
</tbody>
</table>

**LEGEND**

1. Knowledge of expected conditions
2. Observation of real conditions
3. Understanding of real conditions
4. Implementation of safe-working conditions
5. Third-Party communication
6. Maintaining attention despite disturbances
PROJECT

Definition of workers’ SPS profile
Development of simulation scenarios
Development of Non-verbal cues (NVC) tracking system
Simulation sessions
Definition of NVC relevant for safe performance

Video recording (Action Cam)
Physiological recording (Zephyr)
- HR Heart rate
- HRV Heart rate variability
- BR breathing rate
- Activity (accelerometer)

Video recording (LIFE)

Audio recording (Zoom H6)
PROJECT

Definition of workers’ SPS profile
Development of simulation scenarios
Development of Non-verbal cues (NVC) tracking system
Simulation sessions
Definition of NVC relevant for safe performance

Live Video (Action Cam)
Live Audio (Action Cam)
Live Physio (Zephyr)
Live Video (LIFE) x4

Expert panel
Correlation of NVC with SPS checklist and other performance assessments

Outline of the behavioural, non-verbal parameters that describe an effective team coordination for the task management
Outline of a global assessment tool

Implementation of a training method based on simulation addressing both NVC and SPS

PROJECT
The effects of training can be evaluated on 4 levels (Kirkpatrick, 1976):

1. Reaction: satisfaction, engagement, perception of utility
2. Learning: knowledge, skills, attitude
3. Behaviour: application of what is learned to the job
4. Results: outcome on business and organizational performance (i.e. safety)

Our levels:

• Level 1 Assessment: POST COURSE QUESTIONNAIRE
• Level 3 Assessment: SELF REPORT SPS QUESTIONNAIRE
POST COURSE QUESTIONNAIRE

Scale was on a 5-point Likert scale from 1 = “not at all” to 5 = “a lot”

<table>
<thead>
<tr>
<th>Item</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open climate</td>
<td>4.88</td>
</tr>
<tr>
<td>Engagement and active participation</td>
<td>4.38</td>
</tr>
<tr>
<td>Realism of scenario scripts</td>
<td>3.38</td>
</tr>
<tr>
<td>Realism of simulation setting</td>
<td>3.5</td>
</tr>
<tr>
<td>Usefulness of the training</td>
<td>4</td>
</tr>
<tr>
<td>Usefulness of theoretical part</td>
<td>4.38</td>
</tr>
<tr>
<td>Usefulness of active simulation</td>
<td>4.38</td>
</tr>
<tr>
<td>Usefulness of observing simulation</td>
<td>4.5</td>
</tr>
<tr>
<td>Usefulness of debriefing</td>
<td>4.25</td>
</tr>
<tr>
<td>Willingness to repeat training</td>
<td>3.75</td>
</tr>
<tr>
<td>Satisfaction for training</td>
<td>4.38</td>
</tr>
</tbody>
</table>

N = 8
SELF REPORT SPS QUESTIONNAIRE

26-item self report questionnaire (Cronbach’s α = .84, inter-item mean correlation = .17)

5-point Likert scale (1 = “Never”; 5 = “Always”).

- experimental group (N = 8)
- control group (N = 21)
- before the training and 3 months after

Significant increase of the SPS behaviours in the experimental group compared to the control group after the training
<table>
<thead>
<tr>
<th>Process</th>
<th>Task</th>
<th>Partner</th>
<th>Outcomes</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition of SPS profile</td>
<td>Focus Groups with practitioners</td>
<td>DISFOR e-distribuzione</td>
<td>Description of safe behaviors</td>
<td>Complete</td>
</tr>
<tr>
<td></td>
<td>Development of SPS checklist</td>
<td></td>
<td>List of desiderable profile of SPS</td>
<td>Complete</td>
</tr>
<tr>
<td>Development of simulation scenarios</td>
<td>Meeting with practitioners and expert</td>
<td>DISFOR e-distribuzione</td>
<td>Set of scenarios</td>
<td>Complete</td>
</tr>
<tr>
<td>Development of Non-verbal cues (NVC) tracking system</td>
<td>Analysis of work situation to extract relevant NVC</td>
<td>NEAD DISFOR e-distribuzione</td>
<td>Definition of NVC</td>
<td>Complete</td>
</tr>
<tr>
<td></td>
<td>Technical implementation of sensor based system for NVC</td>
<td>NEAD</td>
<td>Devices for tracking NVC</td>
<td>Complete</td>
</tr>
<tr>
<td>Simulation sessions</td>
<td>Implementation of simulation scenarios</td>
<td>DISFOR NEAD e-distribuzione</td>
<td>Training toolkit</td>
<td>Partially completed</td>
</tr>
<tr>
<td>Definition of NVC relevant for safe performance</td>
<td>Correlation of NVC with SPS</td>
<td>DISFOR NEAD e-distribuzione</td>
<td>Outline of NVC for safe behaviors</td>
<td>Ongoing</td>
</tr>
<tr>
<td>Outline of a global assessment tool</td>
<td>Integration of NVC with SPS checklist</td>
<td>DISFOR NEAD e-distribuzione</td>
<td>Implementation an integrated method</td>
<td>To be done</td>
</tr>
</tbody>
</table>
Thank you

A smooth sea never made a skilled sailor.

—Franklin D. Roosevelt—

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