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Managing Workplace Error Part 1: Unpicking Patterns Of Human Error

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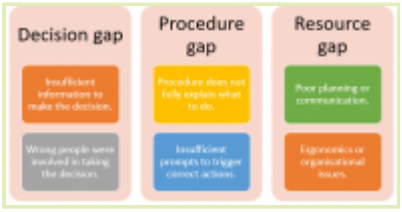

INTRODUCTION

It is well established that regulators do not like the root causes of deviations to conclude ‘human error’ and for the resultant corrective or preventative action (CAPA) to recommend additional training. Instead, regulators expect organizations to go deeper and to unpick the underlying reasons as to why a person made an error and, from this, error risk reduction actions can be initiated. Probing the cause of human error can be achieved through an interactive process, such as by asking ‘why’ multiple times until the answer emerges (this parallels the 5-whys technique or the repetitive questioning of a recalcitrant child).

In a paper published in the Journal of Validation Technology (“Error Risk Reduction: Concept and Case Study”) this author presented risk reduction processes centered on two case studies. The paper demonstrated why simply resorting to ‘human error’ as the root cause of an incident is often inaccurate and generally prejudicial; it also hides too much about how a system functions or malfunctions and hence prevents an appropriate preventative actions from being formulated. As an adjunct to this, this article looks more closely at why human error may occur.

This article is part one of a three-part IVT series:

- **Managing workplace error #1: Unpicking patterns of human error.**
- Managing workplace error #2: Getting to the heart of the matter through human error checklists.
- Managing workplace error #3: Dissecting reasons and causes of laboratory error.

These articles are designed to help organizations to beyond the simplification of a cause as ‘human error’ and to reveal the deeper systematic underpinnings that cause things to go wrong.

THE ‘WHAT’ AND ‘WHY’ OF HUMAN ERROR

Human error can be defined as the action of not producing the expected result (1). Putting aside genuine human non-compliances (deliberate deviations from rules, procedures, regulations etc.), then the root causes of human error can be subdivided into:

1. Memory gap, such as not being able to remember what to do or mistakenly carrying out something from memory believing it is the right thing to do. This area concerns how information is used during the course of an action. Factors which make this error more likely to occur include:
    1. Exceptions to the norm.
    2. Insufficient time to complete a task compared with the normal allocate time.
2. Attention gap, such as something within the external environment (such as noise, light, vibration etc.) that distract the individual. This requires an appreciation of attentional dynamics which involves unpicking the factors that govern the control of attention and the management of mental workload as situations evolve and change over time.
   The above two factors can be associated with the performing of familiar tasks that require little conscious attention. These ‘skill-based’ errors will occur if attention is diverted, even momentarily.
3. Learning gap, such as when the training process has not been successful, and person is not fully competent in how to execute the task. This error can occur due to:
    1. Ineffective training methods.
    2. Failure of evaluate the required learning outcome.
    3. Failure to include coaching within the learning processes.
4. Decision gap, such as when a decision is made that leads to an error. This can be an incorrect decision, a decision made on insufficient information, or the wrong people making the decision (which is the product of the factors related to the knowledge that can be drawn on when solving problems in context). The required behavior is with using the right information to make the right decision about the right thing at the right time. If behavior is based on remembered rules and procedures, mistake occurs due to misapplication of a good rule or application of a bad rule; alternatively, an individual may have no rules or routines available to handle an unusual situation. Here the individual will resort to first principles and experience to solve the problem.
   Factors which make this error more likely to occur include:
    1. Receiving contradictory information.
    2. Lack of available data.
    3. Failure to observe a problem.
    4. Failure to foresee a problem.
    5. Following a weak decision-making process.
5. Procedure gap, where a procedure does not fully explain what to do, especially as a step-by-step set of instructions. Or where there are insufficient triggers to remind the individual what to do and in which order. These can be corrected, such as with flow charts and color coding; there will be several examples of documentation corrigenda Procedural gaps can also relate to a lack of clarity about roles and responsibilities.
6. Resource gap, such as where a task requires x people to complete but only y number of people are available. Resource gaps relate to strategic factors or the trade-offs between goals that conflict, especially when the people must act under uncertainty, risk, and the pressure of limited resources. Resource gaps can arise from ineffective communication, insufficient feedback, organizational constraints, or improper ergonomics. Ergonomics is about ensuring a good ‘fit’ between people and the things they use (2).

For simplicity, these causes can be represented as (Figure 1):

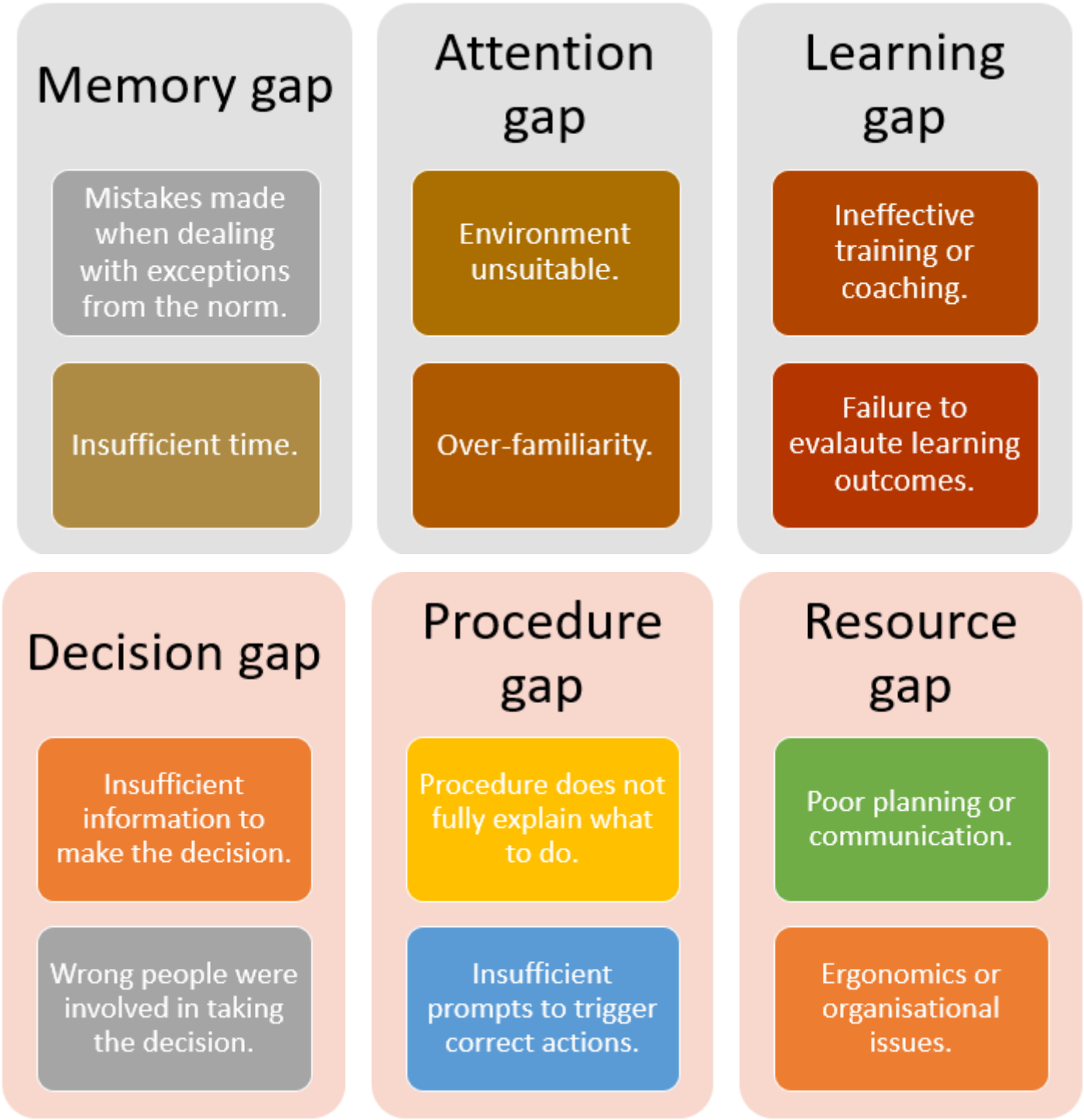

Figure 1: The 'true' root causes of human error

This is not to say that human error does not exit (human fallibility cannot be denied), more so that human-centric incidences could be corrected through better design, an improved system, or organizational led adjustment to work and the work environment. Hence, by analyzing the classes of errors that people make with systems, it is possible to develop principles of system design that minimize both the occurrence of error and the effects.

The above can also be influenced by the work environment, where a non-ideal environment (such as an area that is too cold or hot) or the time of working (such as on shift rotation), leads to errors due to a loss of focus and reduced alertness (3). Personal factors can also combine to make the above more or less likely. These include:

- Physical capability and condition.
- Fatigue (acute from temporary situation, or chronic). Sleep patterns and hours of work can also be a factor in that psychology, physiology and performance are affected by circadian rhythmicity.
- Stress or issues of low morale.
- Work overload/underload.
- Competence to deal with circumstances.
- Motivation as it conflicts with other priorities.

To help to identify these issues, risk assessment can prove to be a useful tool. This may involve identifying those factors that make errors more or less likely, such as poor design, distraction, time pressure, workload, competence, morale, noise levels and communication systems. Such analysis should also account for performance influencing factors and these may lead to the redesign of the task or the way that an item of equipment operates.

Incident Investigations should seek to identify why individuals have failed rather than stopping at 'operator error'. These should produce an action response. Importantly, the action should not rely on operators being well-trained, when it is not clear how the training provided relates to accident prevention or control. In terms of corrective and preventative actions to address the causes of human error, the following make for useful considerations:

1. Chunk tasks. This is the opposite of multi-tasking and is based on simplification. Chunking is concerned with breaking up a work shift into larger chunks instead of reacting to constant interruptions. The more chunks of time devoted to specific tasks, and the fewer start-up moments needed, then efficiency improves commensurately (4).
   A simplification of this is shown in Figure 2:

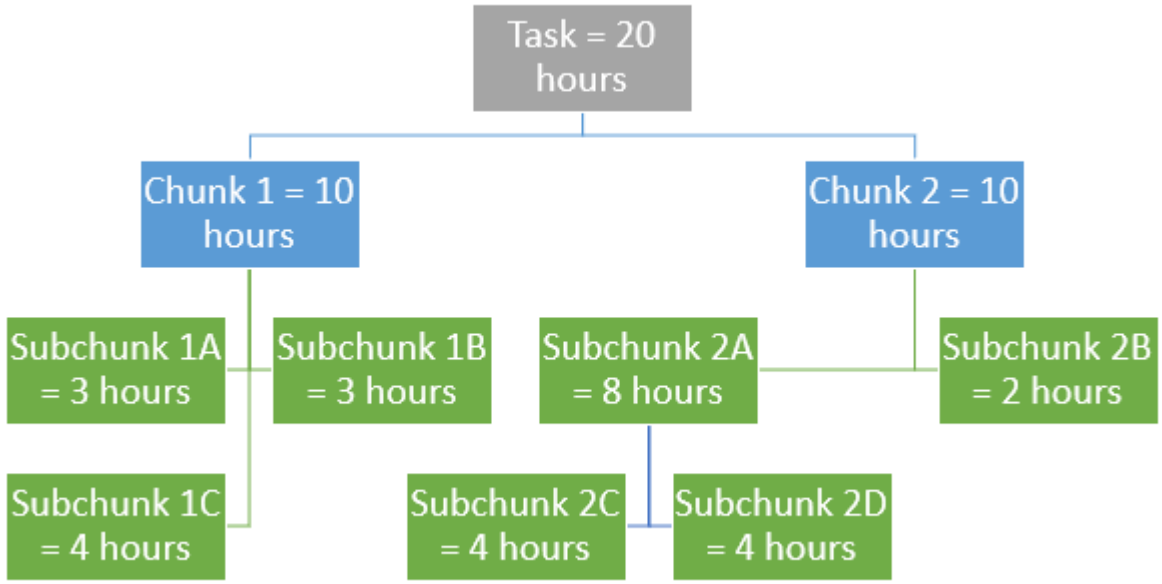

Figure 2: An illustration of chunk and subchunk tasking

Within each subchunk, working should be restricted to 25 minutes, followed by a five-minute break, before resuming (up to the maximum duration of the chunk). This approach is useful because it limits the amount of time the brain is forced to focus, acknowledging that most people can only give full focus to a particular task for short periods of time.

2. Rotate tasks. Task rotation provides more variety, and this can help to retain attention.
3. Change task schedule. Undertaking tasks at different times of the day can help to refresh the mind.
4. Segregating similar tasks.
5. Isolating the activity.
6. Improving procedures by clarifying roles and responsibilities, simplifying language, breaking down instructions into straightforward blocks and ensuring that work is checked.
7. Minimizing distractions
8. Reducing cognitive load.
9. Focusing on the individual, such as (5):
    1. Reducing work environment stressors, such as extremes of heat, humidity, noise, vibration, poor lighting, restricted workspace.
    2. Avoiding extreme task demands, such as high workload, tasks demanding high levels of alertness, jobs which are very monotonous and repetitive, situations with many distractions and interruptions.
    3. Tackling social and organizational stressors, such as insufficient staffing levels, inflexible or overdemanding work schedules, conflicts with work colleagues, peer pressure and conflicting attitudes.
    4. Addressing individual stressors, such as inadequate training and experience, high levels of fatigue, reduced alertness, family problems, ill-health, misuse of alcohol and drugs.
10. Addressing memory gaps, such as (6, 7):
    1. Using color coding triggers.
    2. Using auditory triggers.
    3. Using checklists.
    4. Using scripts or other job aids.
    5. Using pictures and flow charts.
    6. Poka-yoke. This refers is any mechanism in a process that helps an operator avoid mistakes and defects by preventing, correcting, or drawing attention to human errors as they occur. This involves:
        1. Eliminating the step that causes the error.
        2. Replacing the identified step with an error-proof one.
        3. Making the correct action far easier than the error.
11. Refresher training or improving training. The training process can be improved by (8):
    1. Using a four-step training procedure:
    2. Present – Demonstrate – Apply – Feedback
    3. Starting with the easiest part of the training and then add on complexity.
    4. Using assessments to assess training and to include observable criteria.
    5. Ensure there is sufficient time for training.
    6. Ensure there is coaching and sufficient time for coaching.
    7. Providing regular feedback.
    8. Ensure the task being learnt is stable and not subject to change.
    9. Identify any obstacles during the training and seek to alleviate them.

12. Resource gaps can be addressed by:
    1. Clarifying roles, responsibilities, actions, expected performance and desired outcomes.
    2. Alleviating workplace obstacles.
    3. Having effective handovers between shifts.
    4. Checking that messages have been received and understood.

With the above decisions can be improved by teaching personnel to consider the context within which a problem has arisen and to work through the consequences of possible actions. In most cases there will be the need to consult with others and to remain open-minded, being prepared to step backwards and revisit earlier steps if something contradictory emerges.

SUMMARY

This article has investigated some of the causes of apparent human error and how to go beyond this, to look at design, organizational and systematic reasons for the occurrence of a given incident. The article also outlines some of the actions that can be undertaken to reduce what seems to be “human error”. The aim is to assist those who need to undertake human error analysis as a result of a deviation or out-of-specification review, moving down to a greater level of detail as expected by regulators.

In doing so, it is important to proactively identify the conditions that may lead to apparent human error in the workplace and then to review the procedures, environment or work practices that will be most likely to have contributed to the error arising. The second article in the series presents an approach and model for constructing a human error assessment checklist.

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