

# Learning from incidents: applying the 3-P model of workplace learning

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## Abstract

### *Purpose*

Learning from incidents (LFI) is an organisational process that high-risk industries use following an accident or near-miss to prevent similar events. Literature on the topic has presented a fragmented conceptualisation of learning in this context. This article presents a holistic taxonomy of the different aspects of LFI from the perspective of front-line staff.

### *Design/Methodology/Approach*

The 3-P model of workplace learning was used to guide a thematic analysis of interview data from 45 participants, exploring learner factors, learning context, learning processes, and learning products.

### *Findings*

The analysis was used to create a taxonomy of 21 aspects of learning, grouped into themes using the 3-P model of workplace learning. Many of the aspects of learning reflected previous literature, such as the importance of open communication. The analysis additionally demonstrated the interconnected nature of organisational and individual level learning, as well as how formal resources are needed to support informal learning in this context.

### *Originality*

This study presents a holistic taxonomy of LFI from the perspective of front-line staff, addressing a known challenge of LFI literature being fragmented. Additionally, it provides examples of how aspects of organisational learning would influence individual-level learning and vice versa, adding to the relatively sparse number of studies that have explored this aspect. Finally, the paper highlights how informal learning in contexts where workers continually need to make sense of unseen hazards depends on formal learning activities and resources.

### Keywords:

Learning from incidents; 3-P model; workplace learning; thematic analysis; organisational learning; safety science

## Introduction

Following an accident or a near-miss, organisations in high-risk industries will learn by investigating the events that led to the incident (Drupsteen *et al.*, 2013). Following the investigation, a summary of the incident and its causes will be sent to workers across the organisation, allowing individuals to reflect on their own practice without the need to experience an unfortunate event themselves (Author B, 2010). This process, known as learning from incidents (LFI), facilitates organisations learning from the past to develop safer working practices (Le Coze, 2013).

LFI literature has often used a reduction in the number of incidents as a proxy for learning (Madsen *et al.*, 2016). In this line of thinking, learning leads to safer behaviour and therefore fewer incidents. Ergo, if fewer incidents occur then learning must have happened. However, Author B (2017b) has called for a deeper understanding of how learning is fostered after an incident. Studies have shown that learning in this context is complex and takes several forms, ranging from investigators interpreting evidence, to teams discussing an incident summary (Stemn *et al.*, 2018; Author B, 2010). Different aspects of this multi-faceted process have been researched, but the literature remains relatively fragmented without a clear holistic understanding of what it takes to learn and what it should result in (Author B, 2017b). Furthermore, research has yet to fully explore what front-line staff understand as the objectives of LFI. As it is the front-line staff who need to adapt their practices, how they interpret learning activities is an important perspective to understand (Engeström and Kerosuo, 2007). This article addresses the identified gap by presenting a thematic analysis of 45 interviews with workers from three organisations in the energy sector. The analysis identified what workers believed to be successful LFI. In-line with the 3-P model (Tynjälä, 2013), learning was considered from the perspective of desired outcomes, effective learning activities, and supportive environmental and individual factors.

## Theoretical Framework

### *Learning from Incidents*

An incident is defined as an unexpected event that led to a negative outcome or could potentially have done so (Hollnagel, 2014). LFI is an organisational process which consists of seven stages: reporting an incident, investigating, summarising investigation findings, distributing that summary, teams reflecting on how the incident is relevant to their own context, making changes, and, finally, evaluating those changes (Drupsteen *et al.*, 2013; Author B, 2017a). This process should result in learning at both the organisational and individual level. Learning at the organisational level refers to changes to the structures, procedures, and environment in which workers are situated (Author B, 2010). Knowledge from decades of experiences is embedded into sociocultural tools, which workers make use of during their tasks (Lukic, 2012). Organisational learning in LFI, therefore, aims to update sociocultural tools and affect the practice of a multitude of workers.

Individual learning in LFI is achieved through guided reflection using incident summaries. Following an investigation, findings will be summarised into a short report or slideshow. This summary will be shared with workers across the organisation, with the aim to prompt reflection. Front-line teams will discuss the 'lessons learnt' from the incident and make sense of them in a way that is meaningful for their own work (Carroll, 1995). Additionally, individuals learn outside of formal incident meetings by reactively discussing unexpected events with colleagues (Vastveit *et al.*, 2015). While the formal LFI process creates opportunities for individuals to reflect on the relevance of an incident to their own work, workers are continually making sense of incident-information as they encounter new situations in their daily practices. In other words, while change to organisational

tools is mainly driven by the formal LFI process, individual-level learning occurs through both formal and informal means.

### *3-P model of Workplace Learning in LFI*

The 3-P model of workplace learning is a framework that describes interconnected elements of learning in a professional environment (Tynjälä, 2013). It has been operationalised to describe both the individual and organisational aspects of workplace learning processes (e.g., Böhn and Deutscher, 2021). In the model, learning consists of three Ps: presage, process, and product. Presage describes elements that would influence how learning occurs and is divided into two sub-categories: learner factors and learning context. Process encapsulates the variety of different learning activities that occur in the workplace, including both formal and informal aspects. Finally, product refers to learning outcomes. While there are multiple conceptual models of workplace learning, the 3-P model is simple enough for practitioners to understand (Biggs, 1993) but complex enough to address the challenge of unifying disparate LFI literature (Le Coze, 2013).

LFI literature has examined elements of learning from across the 3-P model. When considering presage, for instance, Author B's (2013) qualitative investigation of agency in LFI found several learner factors that would affect how a worker engaged with LFI, such as safety values. With regards to learning environment, Tamuz *et al.*'s (2011) case study of an incident in healthcare showed how context can affect incident learning processes. The case study followed a group of pharmacists who used the investigation of an incident as leverage to push through already desired organisational changes. In this case, the learning process was used not for reflection, but to gain buy-in from management for beneficial changes identified by prior reflection on smaller incidents. While previous work has identified a range of LFI learner factors and environmental influences, studies have not yet identified overarching themes across these two highly interconnected categories that affect the learning process. This analysis will therefore begin to address this gap by exploring, from the perspective of the front-line, what learner factors and contextual elements impact their engagement with LFI.

In addition to presage, LFI literature has provided insight into learning processes and products. There are several different activities that are part of the learning process in LFI, such as discussing an incident with colleagues or exploring recent incident trends (Jacobsson *et al.*, 2012; Rossignol and Hommels, 2017). Although the exact format of the activity may vary, research has found that there are several qualities that would be important across activities in LFI. Examples include organisations providing sufficient time for reflection (Drupsteen and Hasle, 2014), a culture of open communication (Edmondson 2004), and summaries that do not oversimplify incidents (Braut and Njå, 2013). As stated in the introduction of this paper, the aim of this study is to identify what workers perceive as successful learning. As such, rather than naming different activities involved in LFI, the analysis will identify the qualities that are necessary for activities to effectively support learning. In an exploration of LFI practices at a refinery, Vastveit *et al.* (2015) observed that learning occurred through structured activities and daily work tasks, supporting other studies that have found that workers learn about safety through praxis (Yap and Choy, 2018). The analysis will therefore consider both formal and informal learning processes. Finally, studies have identified several examples of desirable LFI learning products. Individual-oriented outcomes of LFI include changes in practice, improved collaboration, and better understanding of risks (Anderson *et al.*, 2013). At the organisational level, learning outcomes might be changes to procedures, such as adding additional checks before carrying out a task, or a database of high-quality incident reports (Jacobsson *et al.*, 2012). As described by Author B (2017b), studies to date have often focused on either organisational learning products or individual learning products. This analysis complements

previous work, such as Lukic (2012), which explored both levels of learning. As with the presage and process themes, the analysis will explore desirable organisational and individual learning products from the perspective of the learners in this context.

## Research Methods

### *Settings and Participants*

Forty-five interviews were conducted with employees of three multi-national energy organisations. All organisations were recruited by advertising the study at an LFI event at the Energy Institute in the UK, and met the following criteria:

- Part of a global energy organisation
- Well-established LFI system
- Committed senior manager who would act as the gatekeeper

Table I shows the characteristics of the three organisations. Participants were recruited from departments in European units of each organisation. In Company A and Company C, participants worked at a single location, close to their colleagues. Company B workers were divided into teams that conducted work at clients' homes. As their job required them to drive to different locations, workers in Company B did not spend much time physically together as a team.

➔ Insert Table I about here

Eighteen participants took part in interviews from Company A from both the production and engineering departments. Eleven participants came from four teams of engineers in Company B. Sixteen workers from a production department of Company C participated in interviews. As can be seen in Table II, participants were from both front-line workers and managerial positions. Managerial positions in this study refer to those who led a front-line team or were directly connected to supporting front-line workers. All participants were male.

➔ Insert Table II about here

Participants were selected in-line with maximum variation sampling, targeting those from diverse backgrounds to maximise the potential for differing views to emerge (Suri, 2011). In this study, a participant's background was based on their job role (engineering, production, front-line, management) and their position in social networks (see Author A *et al.*, 2018).

The study was approved by the Open University's ethics committee (HREC/XXX-blinded). All participants were informed of the purpose of the study and consented to participation before the interviews were conducted.

### *Data Collection and Analysis*

When asked directly about learning, professionals usually describe formal training and neglect informal processes, such as learning on the job (Simons and Ruijters, 2004). Interview questions therefore focused on examples of times when learning would have occurred. For instance,

gatekeepers provided an example of a large incident that had occurred either at the organisation or in the industry. One of the requirements for this incident was that the organisation had devoted time and resources to learning from it. The incident was described to participants who were then asked what changes it had prompted in the organisation, and whether it had impacted their own work.

Thematic analysis was chosen for this study due to its ability to explore perceptions of complex phenomena, such as learning. As highlighted by Braun and Clarke (2020), there are multiple types of thematic analysis, which each has its own underpinning assumptions. The authors employed the framework method of thematic analysis outlined by Gale et al. (2013). The first author initially used the transcripts of participants from Company A to iteratively create a codebook containing themes, codes, and descriptions. Each code represented an aspect of learning in the context of LFI. The inductively generated codes were deductively grouped into themes based on the 3-P model of workplace learning (Tynjälä, 2013). Analysis was supported using the NVivo version 11 software package.

Two additional researchers independently applied the coding scheme to four interview transcripts and the differences with the first author's application were discussed. Several steps were taken to further reflect on the findings: presentations to representatives from the energy sector during the analysis, presentations to participants as findings emerged, and converting the findings into a workshop to actively engage participants in thinking about the concepts and results. An assumption of the analysis conducted in this study is that knowledge is situated, and the researchers' understandings are a resource rather than a bias (Braun and Clarke, 2020). As such, concepts such as data saturation and inter-rater reliability were not appropriate in this analytical approach.

## Findings

Twenty-one codes were identified and organised into the taxonomy of learning shown in Table III. Codes were grouped into themes based on the 3-P model of workplace learning: learner factors and context (presage), learning process, and learning product. While the taxonomy shows each code under one of these four themes, some codes could be considered to overlap multiple themes. In general, presage codes were used for individual qualities (e.g., locative knowledge) or organisational structures and qualities (e.g., organisational memory) that existed outside of LFI oriented activities. Process codes related to the qualities of learning activities. Products described desired changes. Rather than strict categorisation, the codes have been grouped in this manner to help readers make sense of the findings and discussion. To further aid with this sensemaking, the descriptors 'individual', 'organisational', 'formal' and 'informal' are listed next to each code in Table III.

➔ Insert Table III about here

The proportion of participants in each organisation who mentioned each code is displayed in Figure 1. In thematic analysis, a code is not necessarily more important because it was mentioned more frequently (Guest *et al.*, 2014). Nonetheless, frequency can be useful during the interpretation of findings and provides transparency.

➔ Insert Figure 1 here

**Fig 1** Heat-map of aspects of learning mentioned by participants in each organisation

### *Learner Factors*

Several of the learner factor codes related to how participants understood the purpose of receiving incident summaries. When asked how workers should change after receiving a summary, a common response was that changes were usually not necessary. As can be seen from the below quotation, summaries were viewed as a way to develop a safety-oriented mindset, rather than as a driver of change:

*'It's more just opened your eyes, just make sure you're being safe. I mean touch wood I've never had any accidents or anything, but yeah it does open your eyes to just take your time'*

*Participant B4, front-line*

The below quotation from Participant C14 illustrates why a mind-set rather than updated practice might be perceived as the aim of incident summaries: to combat risk normalisation. Working in environments with dangerous hazards where incidents rarely happen, it would be easy to become accustomed to the level of risk.

*'I think if a massive incident happened somewhere in the world today, and then we all got to find out about it, it would make everybody stand back for about 5 minutes and think about what they were doing... But over a period of time it gets forgotten about the, it gets relaxed doesn't it? Everything goes back to normal.'*

*Participant C14, front-line*

As can be seen from Figure 1, developing a safety-mindset was spoken about far more by participants than motivation to learn. This is in sharp contrast with the LFI literature, where motivation has been acknowledged as important to both learning and safety culture (Author B, 2014). The few participants who did mention motivation to learn tended to be managers, such as Participant A8. In his view, if front-line workers were not motivated to learn and change, then any updates to procedures would not be implemented. Since many participants felt that there was no need to change behaviours, it is perhaps not surprising that few people discussed motivation to learn. Participants appeared to be highly motivated to act safely, but this is subtly different to being motivated to learn. Safety usually involves acting in a standardised way that minimises risk, whereas learning involves change (Author B, 2014). Organisations must therefore carefully consider how they intend incident summaries to support learning and make this expectation clear to their workforce.

In relation to informal learning, locative knowledge was acknowledged as important. For example, Participant B9 was a front-line worker who was the designated coach for his team. Due to his role, other team members would frequently contact him with safety concerns. Despite knowing the answers, Participant B9 would not usually tell an engineer what they wanted to know, rather

direct them to the location where they could find that information. He commented, “it's all well and good me going ‘that's the answer’, but they need to find out why it is a risk.” While the formal LFI process creates opportunities to discuss and reflect on incident summaries, incident-related knowledge needs to be embedded into other places, such as databases, that can support informal and reactive learning. However, this information is only of use if workers know where to find it.

### *Learning Context*

Most learning context codes related to the formal organisational setting. For example, communication pathways were described as important because top-down dissemination was the main route through which incident summaries were received. Formal communication pathways connected strongly to another context code: safety as an organisational value. For example, Participant B5 explained the difference he had felt in Company B's values since the new head of their department made it clear that safety should be prioritised over production. The shift in focus made Participant B5 feel that he could now contact his new department head directly with ideas and concerns. The shift in culture had created new avenues of formal communication, providing him with agency to engage with safety and learning. Without a sense that safety was valued by the organisation, front-line staff could see incident discussions as token exercises rather than opportunities for learning. Transparency was another code that related to safety as an organisational value. Participant A6 described an experience where he had requested maintenance on some equipment, but the request was declined without an explanation. Participant A6 found the experience frustrating, interpreting the response as demonstrating an unwillingness to prioritise safety. As highlighted by Author B (2013), these types of perceptions and feelings can often impact willingness to engage in learning activities.

During interviews participants mentioned using several formal resources that contained insights embedded into organisational memory. For example, incidents would often be used as examples in training courses to explain why tasks were conducted in a certain manner. Databases of past incidents were also a key form of organisational memory. Multiple participants provided examples of accessing these formal databases in their informal learning and impromptu communication. For example, Participant C12 said:

*‘I went online and read the, the inquiry reports into what exactly happened and I said, and I printed it off and I underlined or highlighted various things where it was, I said, look it's exactly the same. We're doing exactly the same as what they were doing.’*

*C12, front-line*

In this example, Participant C12 used the database as a resource during discussions with co-workers on safety to make sense of the risks involved with certain courses of action. This example also demonstrates the perceived value of ‘impromptu communication’, as participants spoke about continually talking to colleagues, asking for opinions while they informally learned and made sense of their work.

The final learning context code was company strategy reacts to incidents, which was also connected closely to demonstrating safety as an organisational priority. One example of this code was allocation of resources to safety; in Company B, Participant B9 described how time was set aside at each team meeting to check on the safety of vehicles. Being provided with time for safety tasks

emphasised that it was something that should be prioritised. However, company strategy also included organisational policies such as hiring, annual reviews, and disciplinary action. Participant C7 provided this example of the organisation's internal policies matching the espoused importance of safety:

*'Our bonus that we get paid in March, we get paid it according to us meeting certain criteria within the refinery, as a refinery and also the company as a whole, how they perform. It doesn't just go on performance of production it goes on safety, and it goes on everything else.'*

*C7, front-line*

However, Participant C7 later noted that this was a double-edged sword, as linking a bonus to safety performance could lead to incidents not being reported. Aligning policies so that safety is valued is not an easy task, but would have a large effect on engagement with incident-related learning activities.

#### *Learning Process*

Participants spoke about several factors that impacted how effectively they learnt as individuals. In both formal and informal settings, open and honest communication was viewed as necessary to enable people to share their own experiences and mistakes, as well as respectfully challenge each other. In formal settings, the quality of incident summary affected how effectively learning occurred. In the quotation below, Participant C1 described the importance of the summary format as part of its overall quality, drawing on experiences of summaries which had contained so many details that it was difficult to make sense of the contents.

*'Which, like I say, can be multiple pages of information which people aren't going to read and they'll miss the point that they're trying to get to. So that's the biggest thing, is just purely readability.'*

*Participant C1, management*

Participant A6 added that the nature of the incident was important to consider, as high-quality incident summaries should be tailored to the context in which they were being received. If the summary was perceived as irrelevant, then nobody would learn.

*'Sometimes there are eye-openers, that things that happen on the other side of the world could also happen here, because you have the same situation. So that's always good. And sometimes you get examples, and you think "well, that could never happen here".'*

*Participant A6, management*



However, perceived relevance and overall engagement depended not just on the quality of the incident summary, but on an 'impactful delivery'. In particular, the facilitation skills of team leaders, who were tasked with delivering incident learning sessions, played a large role in the effectiveness of individual formal LFI. Participants described different facilitation approaches with varying levels of interactivity. Interactive approaches that involved thought provoking questions or sharing experiences were perceived as the most effective activities.

While incident summaries were the focus of individual learning activities, an organisational-level learning process was also described by participants: evaluating whether changes made had successfully reduced risk. As described above, LFI at the organisational level means updating sociocultural tools that will influence multiple workers' practices. Participant A17 described below how organisations inconsistently carried out evaluation to understand if any changes made to sociocultural tools would achieve their goals. The evaluation process is particularly important as incidents are rare events. It would be possible to make several changes that do nothing to improve the organisation's tools, or even have an unforeseen detrimental effect. Without evaluation the organisation would not understand that it had made ineffectual changes until another incident occurred.

*'My experience is, of learning from some incidents, is that you always look that, you always look back and you make changes, but you don't check if your consequences, if the consequences of your changes are something you want.'*

*Participant A17, front-line*

Making changes without evaluating their effectiveness could also have an impact on the motivation of workers to learn. Zhao and Olivera (2006) found evidencing learning increases the motivation to report incidents, the first step in the LFI process. While evaluating the impact of an incident follow-up appeared to be inconsistent, all organisations emphasised monitoring activities, such as analysing incident trends and conducting audits. Time for monitoring general work practices was built into the routines of the organisation. As other studies have found that time is often a limiting factor on the quality of LFI (Stemn *et al.*, 2020), it may be beneficial for organisations to build evaluation tasks of incident-related changes into regular monitoring activities.

### *Learning Products*

Learning products mentioned during the interviews focused on changes at both the organisational and individual levels. In terms of sociocultural tools, participants mentioned updating procedures, best practice, technology, and safety barriers. For example, workers spoke about additional checklists that had been added to procedures following an incident. The difference between procedures and best practice was necessary due to a distinction made by participants between the ways that a task was performed in practice and the official procedures. For example, following an incident at one organisation, participants described how the investigation team had concluded that their procedure was effective if followed. Rather than update the procedure, the investigation team recommended re-training workers on the correct procedure and increased the number of audits related to this task, hopefully changing perceived best practice. Updates to best practice also occurred because of informal learning, resulting from discussions between colleagues. However, these changes were kept as local improvements to a specific team's work. An area for future exploration in LFI would be investigating how improvements to different teams' best practices could

be shared across an organisation. Without avenues to share best practice, each team could come to drastically different conclusions about how an incident is relevant to their work and update their practice accordingly. At best, good ideas from one team will not be capitalised on by another. At worst, the increasingly diverse practices of teams will cause incorrect assumptions about the work of others and could lead to an incident.

At the individual-level, interviews contained examples of learning by improved knowledge of hazards and procedures. For example, in Company C, one participant (Participant C10, front-line) described an incident summary that he had received from another organisation, where a drum had been filled with hot oil and opened prematurely. Under normal circumstances, the oil was cooled using steam followed by water, and then left for three weeks before it was safe to open. In this incident, only steam had been used and then the oil was left an additional five days to cool, resulting in an accident once opened as the oil was still extremely hot. The participant commented that he had not been aware of how long it took oil to lose its heat and would have most likely made the same mistake. His knowledge of the risks of hot oil had increased due to this incident. Participant B2 (front-line), described a similar situation after receiving information on how a colleague had handled an incident related to carbon monoxide. The incident was shared in a team meeting as an example of how his colleague had correctly dealt with the hazard. Participant B2 realised that his knowledge of this procedure had been incomplete, and unknowingly, he had not followed it in the past. In this case, discussing the event allowed a participant to reflect on his past performance and understand how the steps in the procedure managed risk.

## Discussion

This article presented the results of a thematic analysis to conceptualise what 45 workers in energy companies perceived as successful LFI. The codes were grouped into themes based on the 3-P model of learning. The presented taxonomy builds on work, such as Lukic (2012), that explores the organisational, individual, formal, and informal aspects of a complex organisational learning system. Structuring the taxonomy around the 3-P model of workplace learning highlighted the interconnected nature of individual and organisational learning processes in this context. For example, the act of evaluating whether changes following an incident achieved their goals demonstrates the importance of safety. From the perspective of individuals, knowing that the organisation values safety and dedicates time to evaluating changes will have consequences for their motivation to learn from incident summaries (Author B, 2013; Zhao and Olivera, 2006). Organisations are dynamic entities, meaning that it is difficult to investigate every aspect of a multi-level learning process such as LFI. However, with heuristics such as the 3-P model, it is possible for researchers to be explicit about what part of the learning process they are investigating and consider how that may connect to other pieces of the puzzle.

In a similar manner, the examples presented by participants in this study showed a strong link between formal and informal learning. Following incidents, companies invest time into creating resources that integrate into organisational memory, such as incident databases or learning materials for safety discussions. Informal learning in high-risk environments where many hazards cannot be seen requires a high degree of sensemaking. Formal meetings create opportunities for directed discussion which can then be useful while contextualising information on the job. Equally, formal informational resources, such as databases, are essential when workers encounter unexpected situations and try to assess if an incident is likely to occur. Further exploring how formal learning activities and resources support informal learning in the context of LFI would be a beneficial avenue of research.

### *Limitations and Future Directions for Research*

This study's methods have several limitations that should be addressed in future research. Thematic analysis allows researchers to summarise the key themes of participants' views. However, each learner factor, learning context, and learning process code is likely to differ in influence on the learning products. The magnitude of this influence cannot be assessed through qualitative methods. Future work should quantitatively investigate the impact of improving the different influencers on achieving desired learning products. From a practical perspective, organisations will want to improve the aspects of their learning systems that will result in the biggest gains. Quantitative assessment of the different aspects of learning will therefore increase the practical value of the taxonomy.

Furthermore, the results presented here are based on the perceptions of participants. The taxonomy of learning matches previous literature well, lending validity to the findings. However, it is likely that some important aspects of LFI were not mentioned by participants and are therefore missing from the taxonomy. There are a variety of methods that could surface some of these factors, such as learning analytics or observational studies.

### **Conclusion**

This article uses Tynjälä's (2013) 3-P model of workplace learning to present a taxonomy of the different components of successful learning in LFI from the perspective of workers. The taxonomy is a starting point for understanding how practitioners perceive learning. As LFI literature has presented a fragmented understanding of learning (Le Coze, 2013), studies should be explicit about what aspect of learning is being investigated. The findings of this study highlight the interconnect nature of individual, organisational, formal, and informal learning in this context.

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