

Learning from errors in workplace settings

As work is a setting of performance, workplace settings usually are neither error friendly nor learning oriented. Hence, discussing learning from errors in workplace settings is of particular challenge. Business organization started to consider errors from a new perspective when the principle of Kaizen was introduced as business and management concept during the 1990s. Before that time, business – and particularly production – was characterized by a division of labor with exactly defined working steps and strictly separated the planning and the execution of work. The individual worker was considered exchangeable and not in need of instruction. It was Toyota Motor Company that put a stronger emphasis on the individual potential of each worker. By implementing the Kaizen principle, Toyota aimed at a permanent improvement of work processes. In this perspective, workers are considered experts for their field of work who themselves know best where problems arise and how to improve work processes to avoid errors. It is this change of perspective which prepared the floor for discussing learning from errors at work.

Educational research on learning from errors goes back to research on processes of learning and instruction in school contexts. Much of what we know about circumstances that support learning from errors is the result of research on the interaction between teachers and students when errors occur (errors made by students as well as made by teachers; –Wuttke and Seifried, 2017). The origin of research on errors in work contexts started was the area of work psychology (Edmondson, 1996; Frese, 1995). In the field of educational science, the investigation of error-related learning in workplace settings started at about 10 years ago (Bauer and Harteis, 2012; Harteis *et al.*, 2008; Wuttke and Seifried, 2012).

Errors can be manifold (Reason, 1990). To make learning from errors possible, it is important to differentiate errors regarding their sources and causes (Hofman and Frese, 2011). In seeking to understand why errors occur and how best to avoid their repetition, the theory of negative knowledge was formulated (Gartmeier *et al.*, 2008). Negative knowledge is experiential knowledge about what not to do; it is assumed to protect individuals from repeatedly committing errors. So far, we seem to understand the cognitive processes associated with learning from errors quite well. Less we know about non-cognitive (e.g. emotional) processes and about circumstances that enable individuals to learn from errors in workplace environments. It is nowadays common sense that errors cannot be completely avoided, but that a learning-oriented approach can help to prevent the (re)occurrence of errors. Still, many workplaces are characterized by a climate that prevents learning from errors – be it due to immediate (i.e. punishment) or indirect negative consequences (i.e. damaged reputation). The contributions to this special issue address exactly those issues.

Researching learning from errors at work is challenging for various reasons. First, errors have bad reputation, and as workers usually claim to follow the work tasks conscientiously, workers tend to avoid talking about errors they committed. Second, when investigating concrete error situations, it is difficult to compare different cases



because errors can vary widely in their sources and causes. One individual may describe a slip, whereas another individual may discuss consequences of misassumptions. So, it is quite difficult to draw general conclusions from different error situations. Third, an alternative approach draws upon investigating general attitudes toward and beliefs about errors (e.g. error orientation, Rybowskiak *et al.*, 1999). However, when respondents self-report about those attitudes, we still do not learn anything about their factual dealing of error situations.

It is a paradigmatic discourse if learning from errors can only be analyzed through focusing on concrete error situations or if it is possible to generalize across various error cases to develop a general framework of how best to deal with errors at work. The academic discourse on workplace learning is dominated by representatives of the socio-cultural paradigm whose research focuses the understanding of concrete interactions. Even though Sloane (2017) claims the phenomenological approach – emphasizing the researchers' insight as major goal of educational research – as the most appropriate paradigm for improving organizational practices, this special issue presents five pieces of cutting edge research on learning from errors in workplace settings that go beyond such casuistic descriptions of ongoing practices. The papers in this volume are summarized in the following.

The first two studies in the volume focus upon hospitals as workplaces: In the study by Minna Ruoranen, Teuvo Antikainen and Anneli Eteläpelto, the question is raised how operative risks and potential errors are addressed in discussion with surgical residents performing authentic surgical operations. This focus is relevant with regard to the goal of diminishing medical complications resulting from operating errors. Data were collected via video-recoding of five authentic surgical operations and analyzed by a consultant surgeon and an education expert. It was found that guidance given during operations concerned mostly technical issues, such as instrument handling, and that risks and potential errors were rarely addressed. These findings show that the optimal context of learning about risks and potential errors of surgical operation is not always the authentic operation context.

In the subsequent paper by Martin Gartmeier, Eva Ottl and Johannes Bauer, critical incident reporting (CIR) in the hospital setting is conceptualized as a strategy for workplace learning from errors. They report a longitudinal survey study which investigates nurses' cost/benefit evaluations and associated behaviors regarding error reporting. Based on correlational and hierarchical cluster analyses, they identify positive cost-benefit correlations and negative cross-correlations, with no substantial changes over time. Moreover, they differentiate two groups of nurses, "reporters" and "learners", regarding their reporting behaviors.

The following two studies' respondents were auditors (Grohnert *et al.*) and employees from a large sportswear manufacturer (Rausch *et al.*).

Therese Grohnert, Roger Meuwissen and Wim Gijsselaers investigate the influence of organizational climate on learning from errors. Specifically, they focus on espoused (verbally expressed) and enacted (behaviorally expressed) values with respect to learning from errors. In their study, 150 early career auditors responded to a questionnaire; the data were analyzed by means of multiple mediation analysis to explore direct and indirect effects. The authors found the tendency to cover up errors to be negatively, and the tendency to learn from errors to be positively related to an organization's learning from error climate. These results highlight that

organizations can actively discourage covering up errors, and foster learning from errors.

In the subsequent paper, Andreas Rausch, Jürgen Seifried and Christian Harteis investigate the complex relationship between emotions, coping approaches and learning in error situations. Their study aims at clarifying the influence of individual and contextual factors on emotional coping with and learning from errors. Their study measures errors *in situ* by semi-structured diaries that were administered to 22 employees. Individual and contextual factors were measured by established questionnaires. The findings reveal that errors typically provoke negative emotions that lead to emotion-focused coping, but that emotions do not have a direct impact on learning. Rather, learning seems to depend on the in-depth analysis of the errors itself.

In the final paper of this special issue, a cross-professional perspective is adopted: Alberto Cattaneo and Elena Boldrini present instructional scenarios from different professional domains where errors are made functional to learning in vocational education and where video technologies have made this both feasible and effective. In particular, they report about studies with handcrafts (clothing designers and butchers), commerce (office clerks) and health (surgical room nurses). Their contribution shows the role errors can play across professions to sustain learning from workplace practices, even in simulated conditions which provide safer circumstances and an open, learning-oriented climate.

Christian Harteis

Institute of Education, University of Paderborn, Paderborn, Germany, and

Martin Gartmeier

TUM School of Medicine, Technische Universität München, München, Germany

References

- Bauer, J. and Harteis, C. (Eds) (2012), *Human Fallibility: The Ambiguity of Errors for Work and Learning*, Springer, Dordrecht.
- Edmondson, A.C. (1996), "Learning from mistakes is easier said than done: group and organizational influences on the detection and correction of human error", *The Journal of Applied Behavioral Science*, Vol. 32, pp. 5-28.
- Frese, M. (1995), "Error management in training: conceptual and empirical results", in Zuccheromaglio, C., Bagnara, S. and Stucky, S.U. (Eds), *Organizational Learning and Technological Change*, Springer, Berlin, pp. 112-124.
- Gartmeier, M., Bauer, J., Gruber, H. and Heid, H. (2008), "Negative knowledge: understanding professional learning and expertise", *Vocations and Learning. Studies in Vocational and Professional Education*, Vol. 1, pp. 87-103.
- Harteis, C., Bauer, J. and Gruber, H. (2008), "The culture of learning from mistakes: how employees handle mistakes in everyday work", *International Journal of Educational Research*, Vol. 47, pp. 223-231.
- Hofman, D.A. and Frese, M. (2011), "Errors, error taxonomies, error prevention, and error management: laying the groundwork for discussing errors in organizations", in Hofmann, D.A. and Frese, M. (Eds), *Errors in Organizations*, Routledge, New York, NY, pp. 1-44.
- Reason, J.T. (1990), *Human Error*, Cambridge University Press, Cambridge.

Rybowiak, V., Garst, H., Frese, M. and Batinic, B. (1999), "Error orientation questionnaire (EOQ): reliability, validity, and different language equivalence", *Journal of Organizational Behaviour*, Vol. 20, pp. 527-547.

Sloane, P.F.E. (2017), "'Where no man has gone before!' – exploring new knowledge in design-based research projects: a treatise on phenomenology in design studies", *EDeR – Educational Design Research*, Vol. 1 No. 1, pp. 1-29.

Wuttke, E. and Seifried, J. (Eds) (2012), *Learning From Errors at School and at Work*, Budrich, Opladen.

Wuttke, E. and Seifried, J. (Eds) (2017), *Professional Error Competence of Preservice Teachers, Evaluation and Support*, Springer, Dordrecht.