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Individual and contextual factors influencing engagement in learning activities after errors at work: A replication study in a German Retail Bank

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Abstract

Purpose – The purpose of this replication study is to identify relevant individual and contextual factors influencing learning from errors at work and to determine if the predictors for learning activities are the same for the domains of nursing and retail banking.

Design/methodology/approach – A cross-sectional replication study was carried out in retail banking departments of a German bank. In a pre-study, interviews were conducted with experts ($N = 4$) of retail banking. The pre-study was necessary to develop vignettes describing authentic examples of error situations which were part of the questionnaire. The questionnaire was filled out by 178 employees.

Findings – Results indicate that the estimation of an error as relevant for learning positively predicts bankers' engagement in social learning activities. The tendency to cover up an error predicts bankers' engagement negatively. There are also indirect effects of error strain and the perception of a safe social team climate on the engagement in social learning.

Originality/value – This paper contributes to the generalization of results by transferring and testing a model of learning from errors in a domain different from the previous domains where this topic was investigated.

Keywords Vignettes, Retail banking, Informal learning from errors, Informal workplace learning, Replication study

Paper type Research paper

Introduction

Informal learning at the workplace occurs in critical moments in practice. It happens when people have the need or the opportunity for learning, for instance, in problem situations that require solutions (Marsick and Watkins, 2001; Manuti *et al.*, 2015). Informal learning can be characterized as a conscious inductive process of reflection and action, integrated in work and daily routines and triggered by an internal or external cause (Marsick and Volpe, 1999). It is seen as a key factor to increase capacity of individuals and organizations to face the challenges of the fast-changing environment (Russ-Eft *et al.*, 2014).

Informal learning can be triggered by some kind of internal or external stimulus that signals dissatisfaction with the current ways of thinking or being. Triggers in the external environment can be, for instance, changes in the job task or the demands of a new technology. Internal triggers can be when people change their focus or direction or

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want to prepare for future challenges, for instance, by rehearsing (Marsick and Watkins, 2001; Marsick and Volpe, 1999; Ellinger and Cseh, 2007). Errors can be external triggers for informal learning activities at work (Bauer and Mulder, 2007; Kolb, 1984). Learning from errors at work can be regarded as a sub-category of informal experiential learning at work (Bauer and Mulder, 2007). The potential of learning from errors has received increased attention in research and switched the focus from strategies of error avoidance or error prevention (security management and quality management) to using errors as triggers for informal learning processes and organizational development (Russ-Eft *et al.*, 2014; Bauer *et al.*, 2012; Lukic *et al.*, 2010). But because of the wide variance in types of errors and different operationalization of learning processes after errors, studies on individual learning from errors and the conditions that lead to these learning processes are still rare (Bauer *et al.*, 2012; Bauer and Mulder, 2007). The domain of nursing and medicine has received most attention in this research, probably because of the potential serious effects of errors for patients' health (Aspden *et al.*, 2004; Wachter *et al.*, 2002; Cramer *et al.*, 2013; Leicher *et al.*, 2013).

The domain of retail banking is characterized by changes and can be described as a dynamic field of work which includes a high risk of error occurrence (Hetzner *et al.*, 2011). Workplace affordances include innovativeness, risk taking and personal initiative, which, therefore, simultaneously, increase the likelihood of errors (Kriegesmann *et al.*, 2005). With the economic turmoil, an ongoing internalization of banking, and an increase in new technology, the need for learning increases in this domain (Antonacopoulou, 2004; Adizes, 2014). These changes create new opportunities for financial services. Traditional barriers to market entry have disappeared and, therefore, the banking industry is able to reach new customers and use new technological opportunities. These new market conditions also increase competition (Blazevic and Lievens, 2004; Harris, 2002). Learning from errors is especially important in this domain because new regulation issues regarding bank structures and legal forms have been implemented after the financial crises (Holland, 2010). Because the banking staff have to handle the challenges of a constantly changing turbulent environment, the likelihood of errors is high. In a domain with such high risk, the importance of learning activities from errors is growing (Froehlich *et al.*, 2014; Hetzner *et al.*, 2009). Research on informal learning in the retail banking sector emphasizes the role of reflection in professional work, which is influenced by individual characteristics such as personal initiative and self-efficacy as well as organizational aspects such as the perceived level of psychological safety within a team (Hetzner *et al.*, 2014). Furthermore, leadership style and the organizational learning culture influence learning approaches of employees and their informal learning activities at work (Froehlich *et al.*, 2014). As a result, learning activities at the workplace can increase job satisfaction of employees in the retail banking sector (Rowden and Conine, 2005). Research also indicates that errors are important for reflection of professionals in the retail banking sector. Hetzner *et al.* (2011) showed that the competence to cope with errors and the estimation of error-related learning situations as relevant for improvement of knowledge and skills are significant predictors for reflection. The perceived level of psychological safety mediates the relation of attitudes toward errors and reflective working behavior. Their results indicate that errors are an important source for learning in the domain of retail banking. Learning from errors includes reflection in the way of analyzing the causes of an error but also the development of new action strategies and alternatives for future

acting. The aim of learning from errors is not the prevention but the development and implementation of strategies such that the chances of errors to happen decrease. Studies indicated that learning activities after errors are positively related with the performance of organizations (Van Dyck *et al.*, 2005).

In our study, we focus on factors that influence the engagement of retail bankers in social learning activities after an error occurred. Based on findings from studies on learning from errors at work in the domains of hospital and elder care nursing (Bauer and Mulder, 2011; Leicher *et al.*, 2013), we conducted a replication study in the retail banking sector. The goal of this study is to identify relevant individual and contextual conditions for learning from errors at work in this domain. Furthermore, we want to find out if the predictors of learning activities are the same as those in previous studies in the domains of nursing.

Learning from errors: error types, learning activities and conditions

Definition and types of errors

Errors can be defined as individual actions that are carried out in such a way that a goal is not achieved and the achievement of dependent goals is endangered (Reason, 1990; Frese and Zapf, 1994; Glendon *et al.*, 2006; Senders and Moray 1991). Therefore, all errors can be seen as a deviation either from a current intention or from adequate action strategies toward a goal. Errors can be divided in two groups: slips and lapses and knowledge- and rule-based errors. Slips and lapses are defined as execution failures and are caused by an attention lack or memory failures. Knowledge- and rule-based errors occur when knowledge or rules are not applied or are applied in a wrong way (Reason, 1995). Based on their level of cognitive regulation, knowledge- and rule-based errors contain a higher potential for learning and reflection on experiences (Reason, 1995; Glendon *et al.*, 2006; Keith and Frese, 2005; Rybowiak *et al.*, 1999).

Engagement in social learning activities

The theoretical framework in support of learning activities after errors is based on theories of experimental learning and informal workplace learning (Billett, 2004; Boshuizen *et al.*, 2004; Kolb, 1984; Kolodner, 1983). The activity perspective on experiential learning focuses on learning as a self-organized effort to improve performance and models learning as a action–reflection–action cycle (Boshuizen *et al.*, 2004; Glendon *et al.*, 2006; Gruber, 2001; Kolb, 1984). Bauer and Mulder (2007) define learning from errors as a sub-category of informal experiential learning which uses the construction of knowledge from an episodic event. The theoretical framework for learning activities as an adaptive process includes learning activities of:

- reflection in the way of analyzing the causes of an error;
- development of new action strategies which includes the consideration of ways to change the causes or alternatives for future acting, the allocation of information and resources and planning of the implementation; and
- the experimenting and evaluation of new strategies which lead to the implementation of the developed action strategy.

All these learning activities can be performed individually or socially shared.

Theories on informal learning at the workplace emphasize the significance of social learning opportunities because the social context influences the interpretation of the

situation as well as the implementation of action strategies, and therefore, learning (Marsick and Watkins, 2001; Eraut, 2004). Previous research on learning from errors showed that socially shared learning activities are particularly relevant as part of learning from errors (Bauer *et al.*, 2012; Bauer and Mulder, 2011; Leicher *et al.*, 2013). Sharing information and exploring work-related issues can lead to a permanent change in teams' collective level of knowledge which can include information about errors and solutions and strategies to avoid errors in the future (Van den Bossche *et al.*, 2011; Cannon and Edmondson, 2001). Similar to the previous studies on learning from errors in the nursing sector, we conceptualize learning processes from errors as the individual engagement in social learning activities (ESLA). This is also based on the aforementioned theoretical assumptions which recognize learning from others as an important source for learning at the workplace depending on the individual agency (Eraut, 2004). Because of differences between the domains of nursing and retail banking, we included variables on teamwork preference and task interdependence to ensure that social learning activities are also relevant in the domain of retail banking.

Individual and organizational conditions for engagement in social learning activities

Both individual and organizational factors have to be taken into account to find out what conditions foster or inhibit ESLA (Billett, 2012). In studies on nurses' ESLA, individual cognitive, emotional and motivational aspects were investigated. Furthermore, the individual perception of the perceived safe team climate was included:

- Cognitive aspects refer to the estimation of an error as relevant for learning (*relevance to learning*) and describe reflection processes that are necessary for the inquiry about the causes of an error.
- Emotional experience after the occurrence of an error can determine the ESLA. *Error strain* means having negative emotions caused by making an error, and this can lead to fear and high emotional reactions in error situations (Rybowiak *et al.*, 1999).
- Emotional reactions are also related to the tendency for *covering up errors*. This reaction to the occurrence of an error can be caused by a fear for accusation or job insecurity. Therefore, it can be seen as a motivational tendency and determines if errors are communicated to others or not (Rybowiak *et al.*, 1999).
- The perception of the organizational context, in particular the perception of the team climate, is an important condition for learning from errors. Interpersonal trust and mutual respect within work teams are important conditions for openly addressing errors. *Safe team climate* as the perception of team members that a team is safe for interpersonal risk taking can foster the ESLA (Edmondson, 1999).

Learning from errors in nursing domains

Based on the aforementioned theoretical framework, a model of individual (relevance to learning, error strain and tendency to cover up errors) and organizational conditions (perception of a safe team climate) for the ESLA has been tested in studies on hospital nurses' ESLA (Bauer and Mulder, 2011) and, in a replication study, on elder care nurses' ESLA (Leicher *et al.*, 2013). In the original study on hospital nurses' ESLA, Bauer and Mulder (2011) tested the model with a vignette-based questionnaire study ($N = 276$) and showed that the estimated relevance to learning is a positive predictor ($\beta = 0.28$) and the

tendency to cover up errors is a negative predictor ($\beta = -0.33$) for hospital nurses' ESLA. Error strain and the perception of a safe team climate were not directly predictive of ESLA, but the error strain was found to be correlated with the estimated relevance to learning ($r = 0.51$) and a safe team climate with the tendency to cover up errors ($r = -0.44$). These findings were replicated in a survey with 180 elder care nurses also using a vignette-based questionnaire. In particular, there was evidence that the subjective relevance of an error for learning ($\beta = 0.41$) and the tendency to cover up errors ($\beta = 0.54$) influence elder care nurses' ESLA. The relation of error strain ($\beta = 0.38$) and the perception of a safe team climate ($\beta = -0.59$) was completely mediated by the other variables.

When comparing the domains of hospital nursing and elder care nursing, differences can be found regarding the work tasks and goals (e.g. recovering of health in the field of hospital nursing versus supporting elder people's independence and self-determined life in elder care nursing). Similarities of the domains lie in characteristics of the work contexts as dynamic fields of work in which knowledge and work conditions change frequently (Leicher *et al.*, 2013). Compared with these domains of nursing (hospital and elder care nursing), work tasks and pursuit in retail banking are different. While nurses mostly work in non-profit organizations and are responsible for the care of their patients, client advisors are responsible for monetary profit for their customer and for their organization. The objective of this study is to investigate retail bankers' learning activities from errors at work and to validate the model in a different domain. The work context of retail banking is also fast changing including workplace affordances of innovativeness and risk taking which simultaneously increase the likelihood of errors to occur (Kriegesmann *et al.*, 2005). In accordance with the original study (Bauer and Mulder, 2011), we hypothesize that individual factors (*relevance to learning, error strain and the tendency to cover up errors*) and organizational factors (*estimation of a safe team climate*) influence client advisors' ESLA.

Method

We conducted an interview study with experts (Phase 1) and a questionnaire study (Phase 2) in the retail banking sector. In both studies on nurses' ESLA, we used the vignette technique. These vignettes had to be developed. Therefore, an interview study was carried out. Vignettes are short descriptive stories of an incident of practice presented to elicit rich but focused opinions and reactions to its content (Finch, 1987). In the questionnaire, we asked participants to choose one vignette and answer questions about their ESLA with regard to the described error situation. By using the vignette technique, we investigated intended learning activities with regard to a specific error situation (Mulder, 2015; Bauer and Mulder, 2007).

Phase 1: pre-study for the identification and development of error vignettes

To collect examples of relevant error situations in the domain of retail banking, we conducted an interview study with experts ($N = 4$). Based on the examples of error situations given by the experts, we were able to develop three vignettes describing authentic and realistic error situations.

Selection criteria for the experts were that they had at least ten years of work experience and a supervisory function. We chose these selection criteria because having long work experience does not only mean to have extensive knowledge, but also to have

broad experience regarding domain-specific tasks and solutions for dealing with complex problems (Gartmeier *et al.*, 2010). This also includes knowledge about relevant error situations in the domain. The supervisory function was used as selection criteria because it is part of a supervisor's role to have a critical perspective toward and an overview of their department (Bauer and Mulder, 2007). Furthermore, the role of a supervisor implies a central position within a work team, with a supervisor being able to define what constitutes errors in his domain and being able to describe error situation that may occur to all team members.

One participant in our interview study is a coordinator of several departments, two experts are office managers and one expert is a vice manager of a retail banking department (occupational experience M = 25.0; SD = 13.4). Experts for our interview study work for the same German bank as the participants of our questionnaire study. For the interviews, we used a semi-structured guideline. We started with questions regarding the participants' professional qualification and occupational experience. Then, we gave the experts information about different types of errors. The main part of the interviews was mostly non-directive. Participants were asked to describe concrete examples of situations were knowledge- and rule-based errors occurred. The saturation point was reached when the last expert mentioned the same examples as the other experts and no further information about error situations was gained (Seidmann, 2013). The interviews were recorded and transcribed verbatim. As in the studies on nurses' learning activities from errors, we used a category system based on Reason's (1995) subcategories of knowledge- and rule-based errors.

The examples of error situations described by the experts refer to the subcategories of wrong application of a correct rule, deficits in knowledge and application of a bad rule. Examples of errors regarding the non-application of a correct rule refer to liabilities in the lending process or the protection of the banking confidentiality. An example caused by deficits in knowledge is a wrong or incompletely filled out securities business consultation record. An example that was categorized to the sub-category application of a bad rule is the wrong proceeding regarding the disposal of securities and bonds.

The most frequently mentioned error examples were chosen to develop authentic vignettes. We developed three vignettes that had to meet criteria regarding their style, content and design processes. Vignettes include 50-200 words, have a narrative character but do not use dialogues (Jeffries and Maeder, 2004). They should start with a heading that include a reference to the context where the problem or situation can be found. Regarding their content, vignettes have to be context-sensitive and realistic. Furthermore, vignettes have to be authentic, so that the described incident is relevant to all participants and standardized in a way that all participants are able to respond to the same trigger (Mulder, 2015). The developed vignettes were part of the questionnaire Appendix I. In the questionnaire study, participants were asked to choose one of the error vignettes and answer questions with regard to the described situation.

Phase 2: engagement in social learning activities

Design and sample. We conducted a cross-sectional study on retail bankers' ESLA after errors at work. As mentioned before, errors can be an important source for learning in the domain of retail banking. Participants in our study were fully qualified retail bankers working in German retail banking departments. Their respective fields were services at the bank counter, lending business and investment business. Our final

sample consists of $N = 178$ retail bankers from 32 retail banking departments of a German bank. Participation in the study was voluntary, and the data were handled confidentially. We collected background variables about the retail bankers' age ($M = 31.9$; $SD = 11.0$), educational qualification (110 client advisors, 33 banking specialists, 24 business administrators and 4 insurance salesmen, remaining participants provided no information) and occupational experience (46.8 per cent of participants have more than 10 years of occupational experience).

Instrument and scales. To measure retail bankers' ESLA, as well as individual and contextual factors for these learning processes, we used the same scales as in the studies on nurses' learning from errors. Because of the differences of the domains, we had to change the phrasing of some items, for example, 'retail banking department' instead of 'living area of the retirement home'. Similar to the original studies, ESLA was measured by three scales:

(1) a general openness to discuss the error with others (*general cause analysis*);

(2) joint reflection on specific possible causes for the error (*specific cause analysis*); and

(3) discussing new ways of behavior or new guidelines to prevent similar errors (*development of new strategies*).

As an individual factor for learning from errors, we measured the individual error orientation with three scales:

(1) the estimation of an error as relevant for learning (*relevance to learning*);

(2) the emotional strain caused by an error (*error strain*); and

(3) the motivational tendency to cover up errors (*covering up errors*).

As a contextual factor, we measured the individual perception of a safe team climate with scales about the perceived level of trust among the team members and a non-punitive orientation within the work team. The answer format was a six-point Likert scale, with lower numbers indicating higher engagement or agreement. Table I shows descriptive statistics. Means and standard deviations indicate that retail bankers are frequently engaged in learning activities. To make sure that social learning activities are relevant in the domain of retail banking, we included the control variables' task interdependence and teamwork preference. Task interdependence describes the extent to which employees depend on each other in the accomplishment of work tasks and, therefore, relates to the design of the job and work roles within an organization (Van der Vegt *et al.*, 2001). The individuals' attitude toward teamwork and his/her acceptance of teamwork is measured by teamwork preference (Kiffin-Peterson and Cordery, 2003). We used a validated scale with a five-point Likert answering format for task interdependence, with a higher number indicating higher construct relevance (Van der Vegt *et al.*, 2001), and a seven-point Likert scale for teamwork preference, with lower numbers indicating higher construct relevance (Kiffin-Peterson and Cordery, 2003). The reliability of the scales was satisfying ($\alpha = 0.82$-0.93). In addition, correlations between all variables were computed (Table II).

Analyses. A structural equation model was specified and estimated with Mplus 6 (Muthén and Muthén 1998-2015) with robust maximum likelihood (ML) robust maximum likelihood (MLR) estimation. It was specified exactly like the model used in

Scales	Item example	M	SD	Cronbach's α
Interpretation of error situation				
Relevance to learning	This mistake assists me in improving my work	2.50	0.98	0.84
Error strain	Making such a mistake scares me	3.90	1.25	0.88
Covering up errors	There are only disadvantages for me in speaking about this error with my colleagues	4.92	0.96	0.89
Safe team climate	There is a trustful relationship between the colleagues on my ward	1.99	0.72	0.90
Engagement in social learning activities				
General cause analysis	Discussing with my colleagues why I made this error	2.46	1.16	0.86
Specific cause analysis	Discussing with my colleagues whether there are gaps in my competence	3.84	1.23	0.82
Development of new strategies	Making agreements about new standards and guidelines in a team meeting	3.04	1.04	0.85
Teamwork				
Task interdependence*	In order to execute my tasks in a professional manner, I have to work closely with my colleagues	3.68	0.68	0.83
Teamwork preference**	I prefer working within a team	2.39	1.21	0.93

Notes: Six-point Likert scale, with lower numbers indicating higher construct relevance; *Five-point Likert scale, with higher numbers indicating higher construct relevance; and **Seven-point Likert scale, with lower numbers indicating higher construct relevance

Table I.
Scales and descriptive statistics

Variable	1	2	3	4	5	6	7
General cause analysis	–						
Specific cause analysis	0.49**	–					
Development of strategies	0.54**	0.66**	–				
Relevance for learning	0.25**	0.41**	0.45**	–			
Error strain	0.18*	0.32**	0.38**	0.35**	–		
Covering up errors	−0.38**	−0.13	−0.30**	−0.08	0.15	–	
Safe team climate	0.22**	−0.05	−0.05**	0.28**	−0.04	−0.60**	–

Notes: $^{**}p < 0.01$; $^{*}p < 0.05$

Table II.
Correlation matrix

the studies on nurses' learning from errors (Bauer and Mulder, 2011). General cause analysis, specific cause analysis and development of new action strategies were modeled as a second-order variable. Standard fit indices and cutoff criteria were used to test the validity of our model with the present sample, with the SRMR ≤ 0.10; CFI ≥ 0.90; RMSEA ≤ 0.08, indicating an acceptable fit (Kline, 2010). We also checked the patterns of findings in terms of statistical significance, direction and size of effects. Our

interpretation of effect sizes for the standardized regression weights is based on the standards proposed by Cohen (1988; 0.10 = small, 0.30 = medium, 0.50 = large).

Results

With regard to the control variables, task interdependence and teamwork preference, descriptive statistics indicate that teamwork is relevant in the domain of retail banking. Furthermore, retail bankers show high preference to work together in teams and are personally convinced that teamwork is necessary and useful to accomplish their work tasks (Table I).

The findings for our model indicate an acceptable fit to the data (SRMR = 0.08; CFI = 0.94; RMSEA = 0.07, 90 per cent CI 0.05-0.08; Figure 1). Our results indicate that the estimation of an error as relevant for learning ($\beta = 0.63$) and the tendency to cover up an error ($\beta = -0.33$) significantly predict retail bankers' ESLA. There are also indirect effects of error strain ($\beta = 0.49$) and the perception of a safe social team climate ($\beta = -0.68$) on the ESLA. Both effects were mediated by the estimation of an error situation as relevant for learning and by the tendency to cover up errors. Concerning our findings, it can be assumed that error strain increases retail bankers' desire not to repeat the experience and, therefore, enhance their estimation of the error situation as relevant for learning. Thereby, the estimation of an error has a direct effect on their ESLA. In addition, the perception of a safe team climate reduces the tendency to cover up errors. Covering up errors can be seen as the contrary strategy of engaging in learning activities and, therefore, has a negative effect on retail bankers' learning from errors. Feeling safe within a team can lead to open error communication which is an important predictor for retail bankers' ESLA. The results indicate that the model of learning from errors could be replicated in the domain of retail banking.

Discussion

Both domains, nursing and retail banking, are dynamic and fast-changing work contexts and, therefore, include a high risk of error occurrence. Irrespective of the work

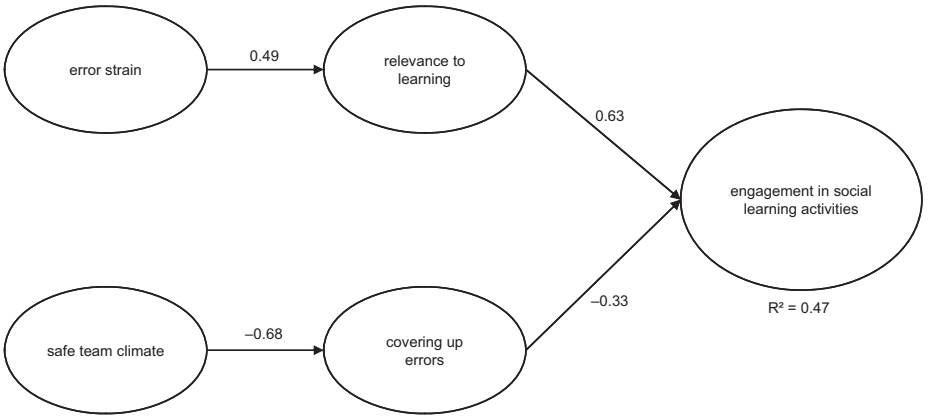

Figure 1.
Standardized estimates for the model for bankers' ESLA ($N = 178$); indirect effects: error strain $\beta = 0.27$; safe team climate $\beta = 0.33$; all estimates $p < 0.05$

Notes: Model fit: χ^2 (82) = 157.219, $p < 0.001$; $\chi^2/df = 1.91$; SRMR = 0.08; CFI = 0.94; RMSEA = 0.07, 90% CI 0.05- 0.08

tasks, giving help and care to the ill and elderly people or being responsible for money, the results of our study indicate that, with regard to learning from errors, similar mechanisms are working.

The estimation of an error as relevant for learning significantly predicts retail bankers' ESLA. This also applies for the tendency to cover up errors which has a negative effect on retail bankers' engagement in learning activities. Error strain and the perception of a safe team climate do have an indirect influence on learning activities. Error strain fosters the estimation of an error situation as relevant for learning and predicts indirect ESLA. The perception of a safe team climate reduces the tendency to cover up errors. The effect is completely mediated by the negative effect of the tendency to cover up errors on ESLA.

We replicated the model of learning from errors at work in the domain of retail banking. Compared with previous studies, the results are in line with research on learning from errors in the nursing sector (hospital and elder care nursing). This study differs from other studies in the domain of retail banking because we used vignettes to describe authentic error situations and asked participants what learning activities they would engage in. We investigated what they would do in an error situation in the content of the specific work context. Nevertheless, as in other studies in the retail banking sector (Hetzner *et al.*, 2014), psychological safety was found to be important, for instance, for reflection on work. Our results are also in line with those of other studies in different domains. Team climate variables that foster open discussion of errors have influence on employees' problem-solving behavior. Furthermore, reflective processes have been identified as an important learning activity after errors (Edmondson, 2004).

Limitations of our study are that we used a self-report instrument and measured only the individual estimation of retail bankers' engagement in learning activities. We describe retail bankers' engagement in learning activities but not what they actually learned from their errors. Furthermore, it should be kept in mind that the goal of our study was to replicate the model on learning from errors which was tested in the nursing domains (hospital nursing and elder care nursing) in the domain of retail banking. The domains differ, for instance, in terms of object of work task, people vs money. Hence, we did not include further variables that possibly could influence the learning behavior of specifically retail bankers. Another limitation concerns our sample. All participants were employees of the same German bank but are working in 32 different retail banking departments. The multilevel structure of our sample was not needed for the object of our study and, therefore, not taken into account. Investigating possible effects of the participants' different locations would require a larger sample.

By using the vignette technique, we investigated learning activities with regard to a specific error situation. Vignettes are used as a methodological tool in research in different domains like health care, nursing and education with a wide range of aspects investigated such as cognition, motivation and beliefs. As a research tool, they simulate real-life experiences and are presented to the participant to elicit focused response and potential solutions for the described problem (Schoenberg and Ravdal, 2000). This could be seen as a strength of our study because we were able to investigate concrete experiences and not only a general assumption (Bauer and Mulder, 2007). But it is necessary to realize that it is impossible to be sure how a participant exactly values the error. A further strength of this study lies in transferring and testing the model of

learning from errors in a domain that differs from the previous research domains. This can be regarded as an important step toward generalization of the model.

With regard to the different work tasks in these domains, normative questions arise as well. Is there really no difference between conditions on learning from errors when errors are harmful to the health of other people or when errors concern money and financing? One possible explanation could be that errors do not exist independently from subjects and norms that determine errors in a specific domain (Bauer, 2008). These norms grounded in the organizational context constitute standards to determine what is an error or a wrong action. Thus, the relevance for learning does not seem to depend on the content of or the consequences of an error, i.e. whether it is a threat to life or a financial loss.

Future research should increase insight in other predictors for learning from errors. Furthermore, other types of errors like slips and lapses should be analyzed in studies on learning from errors to cover the full range of errors that occur in real work life. Comparing how different kind of errors lead to different learning activities could improve our understanding and provide further implications for practice. Studies could also focus on the quality of learning processes after errors to get more insight in how learning is preceded in such situations. In addition, two aspects increase insight in processes that foster learning from errors: characteristics of jobs and context of job tasks, for instance, leadership style and team composition. Longitudinal studies are necessary to get more insight in learning processes and development.

Implications for practice concern trainings such as error management trainings that can foster a positive awareness of the learning potential of errors for development and improvement. Error management trainings incorporate errors during training to prepare employees to better cope with changes (Keith, 2012). In our study, we focused on informal learning processes, and the implication of our results concerns the importance of organizational interventions to establish a learning-oriented error culture (Edmondson, 2004; Glendon *et al.*, 2006; Harteis *et al.*, 2008).

This also concerns leaders of organizations and their leadership style, by which they are able to create and reinforce a culture in which errors are reported, analyzed and alternative opportunities for acting are found (Edmondson, 2011). The perception of a safe and trustful climate within an organization and feeling secure not losing the own job because of an error could eliminate individuals' boundaries to openly address errors. Through interpersonal communication and social learning processes, people are able to develop shared understanding and knowledge about errors and, by this, learn from their error experience (Amankwah-Amoah, 2011). This can be the starting point for engaging in social learning activities.

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Further reading

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Appendix 1

Vignette I: Lending process

A customer visits your banking department because he wants to take out a loan. While checking the customer's creditworthiness, you do not ask him about long-term liabilities with other credit institutions. A default occurs at a later date, and it turns out that the customer has an additional credit with another bank. He is not able to reimburse the loan.

Vignette II: Banking confidentiality

A married couple wants to contract a saving bond. Only the husband comes to the banking department and signs the contract for the saving bond. Because both spouses have to sign the document, you decide to give the document to the husband so that his wife can sign it at home. Work instruction regarding signing documents clearly indicates that documents have to be signed before your eyes. The next day, the wife comes agitated to the banking department and affirms that she does not want to conclude the contract. She wants her money back and because of this, you have to dissolve the agreement of the saving bond.

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