Chapter 7
Measuring Organizational Climate for Learning from Errors at Work

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Errors as Sources of Individual and Organizational Learning

Any attempt to systematize and integrate the literature on errors and their relevance to individual and organizational learning has to begin with a definition of what is meant by "error" and "learning". Surprisingly, many authors addressing errors do not explicitly specify the term (e.g., Martínez-Legaz & Soubeyran, 2003), probably assuming that it is already commonly known. The definitions that we found in the literature can be roughly separated into two groups based on the scientific approach taken. Industrial psychologists who deal with topics such as the boundaries of human information processing and ergonomics (e.g., Reason, 1992) generally focus on the acting individual and define errors as planned actions that unexpectedly fail to achieve intended results or personal goals. Organizational scientists, on the other hand, mainly refer to a system-based definition, which regards errors as deviations from common routines, standards or goals (e.g., van Dyck, Frese, Baer, & Sonnentag, 2005). Both perspectives highlight certain aspects of errors that are crucial to either individual or organizational learning processes. These different scientific approaches to errors and the lack of agreement on their definition might be among the reasons for the scarce integration of theoretical notions and empirical results.

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From an organizational learning perspective, discussing errors and their relevance to learning processes by focusing either on individuals or organizational units neglects the interrelationships between learning processes at different organizational levels (Popper & Lipshitz, 2000), and thus results in restricted or misleading conclusions. Individual errors may foster organizational learning, and vice versa. For instance, advancements of organizational routines and goals might be based on individual errors. At the same time, organizational norms may help individuals to detect their own mistakes. Therefore, we argue for an integrated perspective, which explicitly takes the individual and the organization into account. We define error as a deliberate action (or deliberate omission of actions) characterized by the unintended failure to achieve personal goals and/or the unintended deviation from organizational norms and goals which could have been avoided by alternative behaviors of the acting person (cf. Zhao & Olivera, 2006). This definition leads to a broad concept of errors, including factual mistakes as well as latent errors in terms of near misses (i.e. deviations from organizational routines with potential but no actual negative consequences; cf. Ramanujam, 2003) that may be a regular source of individual and organizational learning processes. At the same time, the definition distinguishes errors from related but distinct constructs such as violations (Reason, 2002), which include deliberate deviations from organizational practices (while deviations are unintended in the case of an error) and enforced behaviors that may lead to unintended consequences, but do not allow for alternative actions.

The Process of Organizational Learning from Errors

In contrast to the lack of a common understanding of errors, there seems to be much more agreement on the meaning of the term "learning" as an experience-based process causing a relatively permanent change in knowledge or skill (Weiss, 1990). According to Argyris and Schön (1978), organizational learning concerns the alteration of organizational behavior ("single-loop learning") or the underlying institutional norms and goals ("double-loop learning"). However, organizational learning may only take place in terms of individuals learning as representatives of their organization within the organizational setting ("learning in organizations") and through the storage of learning results (e.g., in the form of documents, routines, processes, and structures) in order to keep them available, even if learning individuals leave the organization ("learning of organizations"; Popper & Lipshitz, 2000). Models of organizational learning have to acknowledge the interrelation of organizational and individual processes of information processing and storage and to explicitly address and incorporate learning steps at the individual level. However, most of the literature dealing with error-related learning processes focuses either on the level of individuals (e.g., Ohlsson, 1996), work groups and other organizational units (e.g., Cannon & Edmondson, 2001), or on organizations as wholes (e.g., van Dyck et al., 2005). As a consequence, in defining critical aspects of the learning

process, there is a substantial overlap between some authors, and no overlap between others, depending on the specific perspective taken.

We conducted a broad literature search reviewing theoretical work and empirical studies in order to develop an integrated model of error-related learning processes in organizations including different scientific approaches and conceptual levels. In the first step, we identified central stages of learning processes resulting from errors by examining descriptions of actual or optimal learning behaviors when dealing with errors (e.g., Edmondson, 1999) and incorporating explicitly proposed steps of individual and organizational learning from errors (e.g., Bauer & Mulder, 2007). The review resulted in a model describing the idealized process of organizational learning from errors as a succession of four stages (Kolodner, 1983). Spontaneous error handling may include aspects of one learning stage or another, thereby accidentally increasing an individual's ability to deal with errors. Nevertheless, a systematic approach to learning from errors should address all the following four stages in order to utilize the entire potential of errors for individual and organizational development:

1. *Error detection*: Any learning from errors requires occurring errors and mistakes to actually be detected (e.g., Cannon & Edmondson, 2001; Ohlsson, 1996; Zhao & Olivera, 2006). However, it has been shown that errors often remain undetected in daily work life. For instance, Reason (1992) reports error detection rates varying between 38% and 92% for different tasks, which in turn means that 8–62% of the errors remain unnoticed. Therefore, employees' attention has to be consciously directed to potential sources of errors and mistakes in the workplace (Ramanujam & Goodman, 2003) by means of feedback from superiors and colleagues, automatic quality checks that signal product deviations, or erroneous action and the like. Such feedback systems should also include information about potential consequences of errors, illustrating the relevance and potential benefits of active error management.
2. *Error attribution and emotional coping*: Learning from errors is unlikely unless people are able to cope with the emotional pressure resulting from the exposure of committed mistakes (Zhao & Olivera, 2006). Errors signify unsuccessful actions and avoidable failures, which may even result in sanctions, and are therefore accompanied by negative emotions most of the time. The fear of negative error consequences often prevents individuals and organizations from coping with errors in a functional way. While the stressfulness of errors needs to be countered in order to make it possible to learn from them (Heimbeck, Frese, Sonnentag & Keith, 2003), it is still necessary to clarify the responsibility for erroneous actions (Tjosvold, Yu & Hui, 2004). If an actor attributes the error solely to external, uncontrollable causes, he or she will not see the necessity and possibility to actively learn from it. In contrast, recognizing that an error was caused by oneself may motivate employees to actively occupy themselves with errors as sources of feedback that may be used in order to improve their skills and performance (Keith & Frese, 2008).
3. *Error analysis and correction*: A thorough analysis and correction of errors is necessary to identify the circumstances under which errors occur and to acquire

knowledge of how unintended consequences can be avoided in the future (e.g., Bauer & Mulder, 2007; Ramanujam & Goodman, 2003; van Dyck et al., 2005). If causes of errors are unknown and the success of potential ways of error correction are barely predicted, deliberate experimentation can be a fruitful method to gain a deeper insight into the nature of errors and to derive promising strategies for future prevention (cf. Cannon & Edmondson, 2005).

4. *Dissemination of experiences:* Communication and interpersonal exchange regarding error-related experiences is needed to make the results of individual learning from errors available to others within the organization (e.g., Bauer, Festner, Harteis, & Gruber, 2005; Edmondson, 1999; Van Dyck et al., 2005). Employees learn as representatives of their organization, and the acquired knowledge must be retained systematically in advance of their quitting, dismissal, or retirement. As the memory of individual members is the most important store of organizational knowledge (Walsh & Ungson, 1991), dissemination of error-related experiences (causes, consequences, and remedies) is a vital stage in the process of learning from errors.

After having identified the crucial steps of the learning process, we once again examined the literature in search of factors within the work environment which potentially influence the intensity and quality of error-related learning. Compared to the process stages of error-related learning, the literature on influencing factors is much more diverse. Nevertheless, the proposed factors can be integrated into four main areas:

- *Supervisor's behavior*: Team leaders' behaviors are among the most discussed factors influencing the way in which errors are dealt with in everyday work life (e.g., Bauer & Mulder, 2007; Cannon & Edmondson, 2001; Zhao & Olivera, 2006). Supervisors effectively shape error-related attitudes and behaviors of their employees by role modeling (e.g., admitting errors) and a thoughtful execution of rewards and coercive power. For instance, supportive behavior (in contrast to sanctioning) and constructive feedback (in contrast to blaming) of team leaders can help to create an atmosphere of psychological safety in combination with accountability, which are important prerequisites of productive organizational learning (cf. Friedman, Lipshitz, & Overmeer, 2003; Popper & Lipshitz, 2000).
- *Employees' behaviors*: In everyday work life, co-workers can reinforce or mitigate the effect of supervisors' behaviors on error-related learning processes. Furthermore, they can directly facilitate interindividual exchange through active help and emotional support in the case of errors (Bauer & Mulder, 2007) or discussions about the causes and potential consequences of mistakes (e.g., Zhao & Olivera, 2006).
- *Operating procedures and task structures*: Besides the impact of other people within a team, structural aspects of task accomplishment have to be taken into account in order to understand how the organizational context influences organizational learning from errors. This group of influencing factors cover aspects such as clear-cut goals (Cannon & Edmondson, 2001), work standards, real-time performance feedback (in order to detect deviations), specific rules and

processes concerning error handling (Ramanujam & Goodman, 2003), as well as provided resources (e.g., time analysis tools, error-management training, meetings for error-related exchanges such as quality circles; Keith, 2005; Zhao & Olivera, 2006).

- *Organizational principles and values*: It is not only observable aspects of the organizational environment that influence individual and group behavior when confronted with errors but also commonly shared principles and beliefs concerning the evaluation and utilization of errors (Bauer et al., 2005). Organizational values and norms concerning the handling of errors distinguish organizational error-management cultures (i.e. constructively communicating about errors and sharing error-related knowledge to quickly detect and handle them) that promote an organization's ability to learn from errors from dysfunctional error-aversion cultures (i.e. avoiding and hiding errors to prevent blame and punishment; van Dyck et al., 2005).

In summary, based on a literature review, we propose that effective organizational learning from errors entails that employees notice the occurrence of errors, accept their responsibility for errors and manage to cope with the emotional distress caused by this attribution, thoroughly analyze and remove error causes and consequences, and share their learning experiences with others. Within an organizational unit, the effectiveness of each of these learning stages is influenced by the supervisor's and employees' behaviors, operational procedures and task structures, as well as organizational principles and values concerning error handling.

Assessment of the Error-Related Learning Climate

The proposed model of organizational learning from errors outlines the scope of available research on organizational influences on error-related learning processes, highlighting links between different approaches and related studies. As such, it can serve as a systematic approach to assess and improve the quality of organizational learning from errors by evaluating the impact of each of the influencing factors on each of the learning stages. This rationale was applied to develop a questionnaire to assess the organizational climate for learning from errors at work (OLE), an inventory that aims to assess employees' perceptions of error-related learning in everyday work life. In contrast to culture surveys that try to grasp subliminal values and implicit beliefs within an organization, the questionnaire focuses on organizational climate as organizational members' explicit perceptions of relevant aspects of their work environment (cf. Schneider, 1990). This perspective may be the more appropriate approach for two reasons. First of all, according to Schein (1990), organizational culture shapes the manifest aspects of the work environment such as task structures, operational procedures, reward and sanctioning systems, and patterns of communication and conflict handling. In any case, the tacit beliefs and principles themselves remain unobservable and cannot be uncovered through interviews and questionnaires.

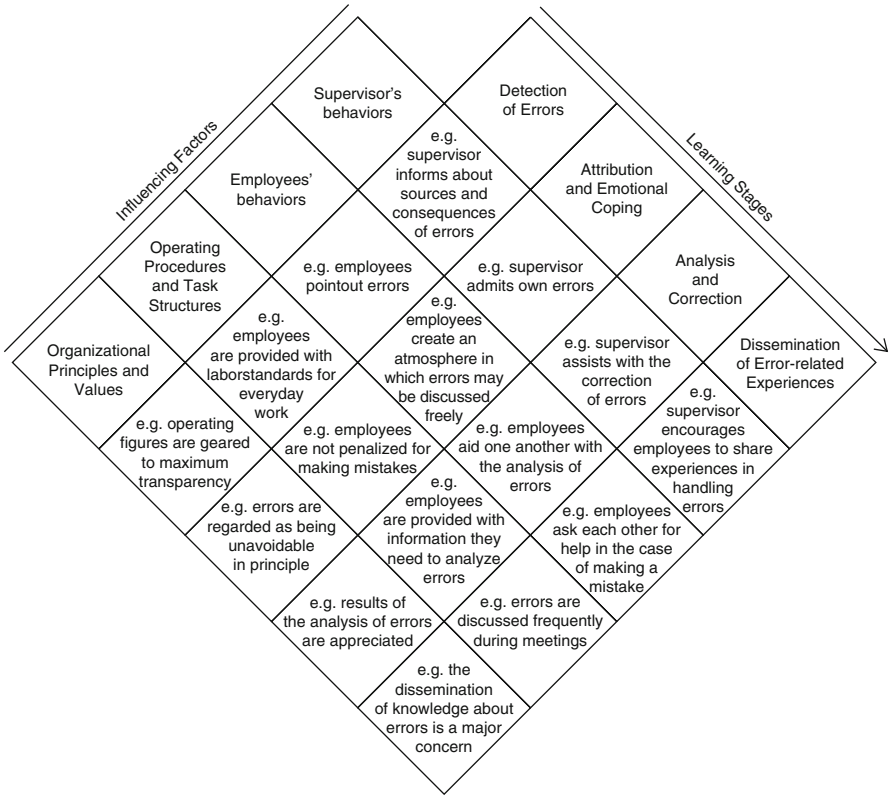

Fig. 7.1 Multifaceted structure of error-related learning climate

Climate surveys based on employees' perceptions may therefore lead to more accurate descriptions of the work environment than organizational members' speculations about the hidden norms and values (van Dyck et al., 2005). Secondly, climate generally addresses organizational aspects that are accessible to targeted interventions, while the development of organizational culture is hardly predictable.

The climate for learning from errors to be assessed by the OLE questionnaire can be defined as the collective perceptions of the members of an organization or organizational unit concerning practices, processes, structures, and behaviors that support or hinder the benefit that organizations can draw from errors. Error-related learning climate can be understood as a multifaceted construct, with each facet representing the supportive or obstructive influence of one context factor (i.e. supervisor's behavior, employees' behavior, operating procedures and task structures, or organizational principles and values) on one of the process stages of organizational learning from errors (detection, attribution, analysis and correction, or dissemination). Figure 7.1 illustrates the postulated facet structure of error-related learning climate and lists exemplary contents for each facet.

Ninety-one statements were formulated based on the model of error-related learning climate as described above to make up the preliminary item pool for the development of the OLE questionnaire. For each item, participants are asked to indicate to what extent they considered it to be an appropriate description of their work group. Several items were removed or revised in the course of pretests with researchers and practitioners dealing with learning from errors or organizational learning, psychology students, and job holders checking for relevance, comprehensibility, and unambiguousness of the wording. In the end, 65 items remained to form the OLE questionnaire, with two to six statements per facet. The OLE score is calculated by summing the item means per facet in order to adjust the contribution of the different learning stages and environmental factors. Appendix lists a sample item for each facet.

Reliability and Validity of the OLE Questionnaire

The reliability and validity of the OLE Questionnaire were initially evaluated in an organizational survey study with 383 German employees of two internationally operating enterprises (Putz, Schilling, Kluge, & Stangenberg, submitted). The evaluation sample consists of 231 salespersons from 24 stores of a clothing retail company and 152 associates of the headquarters of a component supply enterprise, working either in the quality management division, the manufacturing department, or the technical development department.[1] Survey participants can be assigned to 47 teams. The number of respondents from the same team varies between 3 and 16 with a mean of 8.15. Twenty-one respondents did not specify their gender, and 203 of the remaining respondents are female. Participants' mean age was 34 years. 86.1% of them reported an organizational tenure of 1 year or longer. Research questions of this initial empirical evaluation of the OLE questionnaire concerned the replication of the proposed facet model of error-related learning climate, the assessment of the psychometric properties of the questionnaire such as internal consistency and inter-rater agreement, as well as the examination of relations with self-ratings of work-related attitudes and behaviors and performance ratings.

[1] The subsamples may appear rather diverse in terms of task structures and resulting errors. One may therefore expect diverging results concerning the structure and correlates of error-related learning climate for the two subsamples. However, when we compared the results of the analyses reported in the following passages for the two subsamples, we did not find any significant differences. For reasons of better comprehension, we therefore decided to report all results for the combined sample.

Replication of the Facet Model

A principal components analysis of the OLE items revealed a strong general factor. While the eigenvalues of 13 factors exceeded 1.00, the eigenvalues of the first factors are 19.93, 4.65, 2.58, and 2.45, with the first value being more than four times as large as the second one, and the first factor accounting for 30.67% of the total variance. Accordingly, the scree test clearly suggests a one-factor solution. We further assessed the internal structure of the questionnaire by means of confirmatory factor analysis (CFA) with Lisrel 8.72 (Jöreskog & Sörbom, 1993) in order to test the postulated facet structure of error-related learning climate. In order to increase the stability of parameter estimates, we followed the recommendation of MacCallum and Austin (2000) to use item clusters (so-called parcels) based on the facets of error-related learning climate as manifest variables.[2] In order to test the adequacy of our model, we estimated parameters of four partly nested models and compared χ^2, χ^2/df, Root Mean Square Error of Approximation (*RMSEA*), Standardized Root Mean Square Error (*SRMR*), and Comparative Fit Index (*CFI*) to examine data-model fit (Beauducel & Wittmann, 2005).

According to the results of the principal components analysis, we first assessed the fit of a general factor model, which failed to achieve any conventional cut-off criteria of the goodness-of-fit indices examined ($\chi^2 = 1{,}439.49$; $df = 104$; $p < .01$; $\chi^2/df = 113.84$; $RMSEA = .181$; $SRMR = .085$; $CFI = .91$). The data-model fit could be significantly improved by adding four correlated factors indicating either the learning stages ($\chi^2 = 715.67$; $df = 82$; $p < .01$; $\Delta\chi^2 = 723.82$; $\Delta df = 22$; $p < .01$; $\chi^2/df = 8.73$; $RMSEA = .140$; $SRMR = .052$; $CFI = .95$) or the environmental factors to the model ($\chi^2 = 301.96$; $df = 82$; $p < .01$; $\Delta\chi^2 = 1{,}137.51$; $\Delta df = 22$; $p < .01$; $\chi^2/df = 3.68$; $RMSEA = .083$; $SRMR = .032$; $CFI = .98$). Although *CFI* indicates a reasonable to good fit for both models ($CFI \geq .95$ and $CFI \geq .97$, respectively) and *SRMR* indicates a good fit for the latter model ($SRMR \leq .05$), both models have to be rejected according to the other fit indices ($\chi^2/df > 3$ and $RMSEA > .08$, respectively). In contrast, when we estimated the complete facet model (i.e. a general factor plus four correlated learning stages as well as four correlated environmental factors), all fit indices reached the conventional criteria of good fit ($\chi^2 = 100.33$; $df = 60$; $p < .01$; $\chi^2/df = 1.67$; $RMSEA = .041$; $SRMR = .022$; $CFI = 1.00$). Again, the fit was significantly increased in comparison to the more parsimonious model neglecting the phases of organizational learning from errors ($\Delta\chi^2 = 201.63$; $\Delta df = 22$; $p < .01$). Figure 7.2 shows the measurement model including the standardized path coefficients and error terms.

[2] Prior to the CFA, the adequacy of the theoretically based combination of items to clusters representing the facets of error-related learning climate was empirically tested by means of two successive exploratory factor analyses using the parceling method proposed by Jäger and Tesch-Römer (1988), which replicated the expected assignment of items to learning stages and influencing factors, respectively.

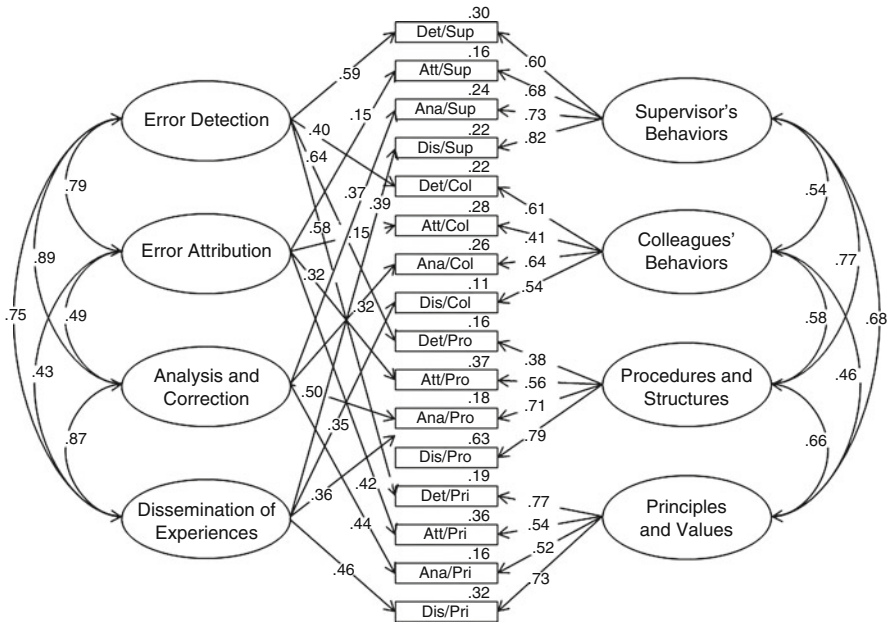

Fig. 7.2 Standardized path diagram of the complete facet model (*Note*. Parcels aggregating all items referring to a certain learning stage and a certain environmental factor serve as manifest variables (e.g., Det/Sup refers to the summed items describing supervisors' behaviors that help or complicate the detection of errors). To enable better inspection, the general climate factor and the corresponding path coefficients on the parcels are not displayed. Path coefficients between the parcels and the general factor range between .02 and .67 with a mean of .21)

Internal Consistency and Interrater Agreement of the OLE Questionnaire

Cronbach's Alpha and Intraclass Correlations (ICC) were calculated in order to assess the reliability of the OLE questionnaire in terms of internal consistency and interrater agreement. Cronbach's Alpha reaches satisfactory levels of .96 at the individual level and .98 at the level of teams. Intraclass Correlations were derived from a One-Way ANOVA with team membership as independent variable (cf. Bliese, 2000). A significant *ICC*(1) of .41 indicates that the assessments of individual persons concerning the error-related learning climate considerably conform to the assessments of the other team members, with about 40% of the total variance being attributable to group membership (Bliese, 2000). In our sample with approximately eight respondents per team, the *ICC*(2) reaches .84, thus clearly exceeding the criterion of .70 of satisfactory reliability of group means, which is a prerequisite for a meaningful interpretation of correlations between error-related learning climate as measured by the OLE and work-related variables at the team level. As can be seen

Table 7.1 Reliability estimates of subscale and a short form of OLE

Scale	Items	M	SD	$\alpha_{Individuals}$	α_{Teams}	*ICC*(1)	*ICC*(2)
OLE total	65	4.41	.70	.96	.98	.41**	.84
Learning stages							
Detection	15	4.56	.80	.90	.96	.53**	.90
Attribution and coping	17	4.33	.72	.83	.92	.40**	.84
Analysis and correction	15	4.61	.77	.89	.93	.31**	.78
Experience dissemination	17	4.11	.80	.88	.92	.23**	.70
Influencing factors							
Supervisor's behavior	16	4.53	.84	.90	.95	.34**	.80
Employees' behavior	16	4.61	.80	.92	.97	.28**	.75
Procedures and structures	17	4.05	.83	.88	.92	.30**	.78
Principles and values	16	4.43	.84	.90	.95	.39**	.84

Note: Means and standard deviations refer to a six-point Likert scale
** $p < .01$
$\alpha_{Individuals}$ Cronbach's Alpha based on individual ratings, α_{Teams} Cronbach's Alpha based on averaged rating per team

in Table 7.1, the aggregation of items according to the learning stages or influencing factors results in scales with satisfactory levels of internal consistencies and inter-rater agreement.

Correlates of Error-Related Learning Climate

We assume that error-related learning climate as measured by the OLE questionnaire will be associated with favorable work-related attitudes and behaviors on the individual level and desired team-level outcomes. In the framework of our empirical evaluation, we actually found that individual perceptions of the way in which errors are dealt with in everyday work life are positively correlated with occupational self-efficacy ($r = .39$; $p < .01$; $n = 251$; *OCCSEFF*-scale by Schyns & von Collani, 2002) and with self-rated personal initiative ($r = .32$; $p < .01$; $n = 250$; scale by Frese, Fay, Hilburger, Lang & Tag, 1997). Furthermore, we expected that employees who described their work environment as supportive of learning from errors would be characterized by functional error-related attitudes (i.e. a positive evaluation of errors, the absence of negative emotions, and a tendency to deal with errors constructively; Bauer et al., 2005; Rybowiak, Garst, Frese & Batinic, 1999). However, OLE scores were only marginally associated with error-related emotions ($r = .16$; $p < .01$; $n = 367$) and cognitions about errors ($r = .21$; $p < .01$; $n = 367$) and showed a much closer relationship to error-handling ($r = .43$; $p < .01$; $n = 367$), indicating that individual perceptions of error-related learning climate substantially impact how that person reacts to and deals with errors, while the cognitive and emotional aspects of error-related attitudes appear to be rather unaffected by learning climate perceptions in the short term.

At the team level, we observed high correlations between the OLE scores and team members' perceptions of group cohesion ($r = .74$; $p < .01$; $n = 47$ teams; cohesion subscale of the substitutes for leadership scales by Podsakoff & MacKenzie, 1994) and task performance ratings of employees and supervisors ($r = .64$; $p < .01$; $n = 47$ teams; newly developed three-item scale; $\alpha = .82$; cf. Putz et al., submitted). An inspection of independent ratings of customer satisfaction and of objective performance indicators that were available for the 24 sales teams revealed that error-related learning climate seems to be primarily associated with adaptive performance aspects. More precisely, in spite of the small sample size, OLE significantly correlated with ratings of trained test shoppers concerning customer service ($r = .49$; $p < .05$; $n = 24$ sales teams), i.e. customer-oriented behaviors that challenge employees to rapidly grasp and satisfy consumers' needs and wishes while avoiding premature misinterpretations and hectic over-reactions. In contrast, OLE scores were not substantially associated with test shoppers' assessment of highly standardized aspects such as presentation of goods ($r = -.13$; n.s.; $n = 24$ sales teams) and customer approach (e.g., when and how to address shoppers; $r = .08$; n.s.; $n = 24$ sales teams). With respect to the objective performance indicators, none of the interrelationships with error-related learning climate as measured by the OLE group means and objective performance indicators became significant. However, the percentage of active sales, i.e. the amount of sales that are generated through active customer contact and consultation, and sales per m^2, correlated slightly with OLE scores ($r = .26$ and $r = .20$ resp.; n.s.; $n = 24$ sales teams) hinting at possible but loose relationships between learning climate and rather distal and complex performance indicators.

Implications for Future Research and Practice Regarding Organizational Learning from Errors

This chapter introduces a comprehensive model of stages and environmental factors influencing error-related learning in organizations. The framework was developed by integrating different theoretical approaches and empirical results from the literature and is to be understood as a preliminary approach to systematize and relate the diverse notions and empirical findings in the field of error-related learning. We found some empirical support for the proposed framework by replicating the intended facet structure of error-related learning climate by means of CFA. The proposed framework may help researchers and practitioners in the field of organizational learning to take a closer look at critical characteristics of work environments and to explore and improve the handling of errors. However, the model as presented here accounts for central but limited parts of error-related learning in organizations focusing on environmental influences of singular learning events in teams. We did not limit our literature review to certain types of studies or theoretical papers, but explicitly included different theoretical and methodological approaches (i.e. work

on individual learning as well as organizational development, correlative as well as experimental studies). Hence, the limited scope of the proposed model replicates previous theoretical and empirical emphases. By pointing at aspects of error-related learning in organizations that are rarely discussed and researched, we hope that our model may inspire future theoretical and empirical work on the relevance of errors for individual and organizational learning, further specifying how, and under which circumstances, errors can trigger and promote individual and organizational development. In line with an emerging body of theoretical discussion and empirical results, the proposed framework may easily be refined and extended by adding subsequent learning stages (e.g., the consolidation of learning experiences) or environmental factors (e.g., the interaction with other work groups) to include previously neglected aspects of error-related learning. Although the model presented is focused on organizational influences of error-related learning processes, researchers primarily interested in the exploration of error-related learning at the individual level may apply the proposed structure of error-related learning processes in order to systematically identify relevant personal characteristics influencing the effectiveness of error handling at the different stages. Adding individual-level variables to the proposed model could help to integrate notions on individual and organizational learning into a common framework, thereby fostering our understanding of error-related learning processes which are likely to be affected by an interaction of personal and environmental factors.

The results of the presented survey study support the reliability of the OLE questionnaire in terms of high internal consistency and substantial interrater agreement. Furthermore, error-related learning climate as measured by the OLE questionnaire was associated with self-efficacy, personal initiative, and constructive error handling at the individual level, as well as team cohesion and several aspects of group performance, namely task performance as rated by employees and supervisors and test shoppers' satisfaction with customer service. In contrast, neither the correlation between OLE scores and customer satisfaction with highly standardized aspects of the selling process nor the relationships between OLE and monetary performance indicators were significant, but showed rather small effect sizes (Cohen, 1992). This differential pattern of empirical relationships with robust effects concerning personal initiative and customer service on the one hand and a failure to prove associations with more objective performance indicators on the other hand leads us to assume that error-related learning climate may be more closely related with contextual performance than task performance in the short term. Thus, in order to more clearly understand the relevance of the quality of organizational learning from errors and performance, future studies should systematically explore the relationship between learning climate and different aspects of performance in the long term, explicitly including indicators of task performance, contextual performance, and counterproductive work behavior (Rotundo & Sackett, 2002).

In contrast to our results, van Dyck et al. (2005) report positive relationships between organizational error-management cultures and self-rated goal-accomplishment

($\beta = .42$ and $\beta = .56$, respectively; $p < .01$) and objective organizational performance indicators ($\beta = .51$ for firm survivability and $\beta = .27$ for return on assets, respectively; $p < .05$) in two cross-sectional studies with German and Dutch enterprises. There are two plausible reasons for this discrepancy in results. First of all, van Dyck et al. examined the influence of organizational culture on performance, i.e. the authors primarily focused on error-related beliefs and practices concerning the prevention of negative error consequences. Beyond that, we explicitly included behaviors of supervisors and employees as well as structural working conditions regarding the detection, attribution, analysis, and correction of errors, and the dissemination of learning experiences in our analysis. The diverging results may therefore be due to conceptual differences between error management culture as introduced by van Dyck et al. and error-related learning climate as presented here. Moreover, one may state that certain facets of error-related learning climate are more closely related to performance than others, which consequently results in attenuated correlations when measures of overall learning climate are observed. However, the relative impact of the environmental factors on the relationship between error-related learning climate and work-related outcomes and their reciprocal effects in supporting or hindering organizational learning have not yet been examined. All the same, further theoretical and empirical work is needed to explore the dynamic interplay between the stages of error-related learning processes and to explain carry-over effects of successive learning events. Secondly, van Dyck et al. found that variations in error management culture are related to different levels of performance *between organizations*, while we did not find comparable correlations between learning climate and objective performance indicators *within one organization*. Compared to the previous study, the variance of performance may therefore be reduced in our sample. Thus, future research on the relationship between error-related learning climate and performance should focus on cross-organizational studies and investigate whether the findings of van Dyck at al. can be generalized to the more integrative construct of error-related learning climate.

The OLE questionnaire may be a convenient tool for the investigation of research questions concerning the differential effects of the environmental factors or stages of error-related learning climate, since its facet structure permits the formation of corresponding subscales (cf. Table 7.1). We are aware that researchers in the field of organizational learning may be cautious about including a general measure of error-related learning climate in their investigations due to the large number of items of the complete questionnaire. We therefore suggest that researchers and practitioners may use the items in Appendix as a short version of the OLE questionnaire. The items cover all facets of error-related learning climate. Their aggregation results in satisfactory reliability estimates ($\alpha_{\text{Individuals}} = .88$; $\alpha_{\text{Teams}} = .94$; $ICC(1) = .36$; $ICC(2) = .80$) and comparable results to those reported for the whole questionnaire.

A major conceptual concern that has to be explicitly addressed when attempting to assess error-related learning climate, as the shared perception of how

errors are typically dealt with in an organizational unit is the situational dependency of error handling. More specifically, the type, severity, and actual frequency of errors, as well as current situational demands (in contrast to characteristic environmental conditions) may heavily influence the organizational reactions to specific errors events. Therefore, in order to validly assess the error-related learning climate, one has to ensure that respondents base their answers on a most comprehensive representation of past error events instead of referring to a few spontaneously memorized mistakes. In the present study, the term error was defined in the instructions to the questionnaire, participants were asked to list errors they had committed or noticed in their work group in the preceding 3 months, and they were instructed to generalize over these different error events when answering the OLE items. All participants mentioned diverse situations representing our broad concept, covering errors directly concerning work tasks (e.g., charging a wrong amount of money, producing an imperfect piece of work) as well as errors in communication with customers, supervisors and employees (e.g., forgetting to provide others with particular information) and inefficient organization of work flow (e.g., missing meetings or appointments). The answers in line with the high *ICCs* representing systematic inter-rater agreement within the work groups seem to indicate that the respondents did actually describe a typical error-related climate rather than single error reactions to specific situations. Nonetheless, differences in OLE scores between work groups may still be attributable to qualitative and quantitative differences in the experienced errors. Future research may investigate the influence of error type and frequency on error-related learning processes (e.g., by means of a content analysis and classification of the listed error events). We recommend that research dealing with error-related learning processes explicitly defines the situations to be assessed and asks participants to specify the error events to which they refer.

Although empirical evidence for the postulated model of error-related learning climate and results on the validity of the OLE must be regarded as preliminary thus far, we encourage practitioners in the field of personal and organizational development to include the questionnaire in organizational surveys. Results from surveys based on the OLE questionnaire may facilitate the discussion about common practices in error handling and may serve as a checklist to sensitize supervisors and employees to unused opportunities in order to improve individual and organizational learning processes inherent in daily work life. In doing so, differences in dealing with errors between several work groups may be uncovered and discussions about the effectiveness of the different approaches and strategies and attempts to institutionalize and standardize them across the organization may be supported. In this sense, errors may not only result in single-loop and double-loop learning but can also inspire reflection about the organization's ability to learn, activities that Argyris and Schön (1978) refer to as deutero learning, as the most effective form of organizational learning.

Appendix: Short Version of the OLE Questionnaire

1. Our supervisor informs his/her employees about consequences that may result from errors in subsequent work processes.
2. Employees can talk to our supervisor about things that went wrong frankly, without suspecting any negative consequences.
3. When someone in our work group has made a mistake, our supervisor helps him/her to correct it.
4. Our supervisor praises his/her employees when they share their experiences in dealing with errors.
5. In our work group, employees call each other's attention to consequences errors can have on their work and the work results of co-workers.
6. Co-workers in our work group act in a competitive manner which makes it difficult to straightforwardly discuss mistakes. (-)
7. When someone in our work group makes a mistake, other co-workers will help him/her to fix it.
8. In our work group, co-workers readily accept hints about how to avoid or correct errors.
9. Employees in our work group are in a position to realize for themselves when they have done something wrong.
10. In our work group, employees are trained about how to deal with stress and fear arising from errors at work.
11. Employees in our work group know how to get the information they need to correct errors.
12. In our work group, there are regular meetings during which employees can also share their experiences in handling mistakes.
13. People in our organization value open discussions about things that have gone wrong in day-to-day work.
14. People in our organization believe that errors at work can be a helpful part of the learning process.
15. When something goes wrong in our organization, emphasis is put on determining the cause.
16. Everybody in our organization is expected to consider what and how other co-workers can also learn from his/her mistakes.

Note: (-): item scores are reversed before analysis

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