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Trainers' responses to errors matter in trainees' learning from errors: evidence from two studies

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Abstract

Purpose – Learning from errors is important for employees, particularly at early stages of their career. The purpose of this paper is to examine the influence of perceived trainer responses to errors on trainee learning from errors in a workplace setting. In Study 1, the authors test a model that examines the associations between perceived trainer responses to errors and trainee learning from errors, which are mediated by affective-motivational adaptivity. In Study 2, the authors further hypothesize that the link between perceived trainer responses and affective-motivational adaptivity is moderated by perceived error climate.

Design/methodology/approach – The authors test the hypotheses using data from 213 Swiss apprentices (Study 1) and 1,012 German apprentices (Study 2) receiving dual vocational training.

Findings – Study 1 suggests that negative trainer reaction impedes trainee learning from errors by impairing trainees' affective-motivational adaptability. Trainer tolerance of errors and trainer support following errors were not related to trainee learning from errors. Study 2 indicates that perceived error climate is an important boundary condition that affects the relationship between trainer responses and trainee learning from errors.

Originality/value – This study contributes to research on learning from errors in three ways. First, it enriches the understanding regarding the role of trainers in enhancing learning from errors in organizations. Second, it extends research on learning from errors by investigating the interaction effects between perceived trainer responses and error climate. Third, it refines knowledge about the role of positive affect in learning from errors. Findings of this study also offer practical insights to trainers and managers regarding what they should do to encourage trainee learning from errors.

Keywords Employee development, Workplace learning, Learning processes

Paper type Research paper

While error avoidance is a crucial issue for quality and safety management in organizations, fallibility is part of human nature and errors cannot be completely eliminated (Frese and Keith, 2015; Zhao and Olivera, 2006). Despite the negative consequences of errors (e.g. wasted resources and suboptimal performance), errors offer valuable opportunities to learn and to improve performance (Lei *et al.*, 2016). In fact, learning from errors has been suggested to play an important role in individual career development and success (e.g. Boss and Sims, 2008; Ohlsson, 1996; Rausch *et al.*, 2017; van Dyck *et al.*, 2005). Although the rationale for learning from errors is clear, the requisite motivation is not always present, even in training programs (Heimbeck *et al.*, 2003; Keith and Frese, 2005). "Errors," as a form of negative performance feedback, can dampen self-efficacy and lead to negative emotions

and dysfunctional reactions, such as blaming others, rationalizing, or ignoring the experience, thus curtailing the opportunity to learn (Zhao and Olivera, 2006).

Learning from errors can be viewed as an activity or as an outcome (Frese and Keith, 2015). We examine learning from errors as an activity and define it as the degree to which trainees engage in processes and actions to minimize error recurrence and to improve task performance. Research has suggested that both contextual and individual factors affect learning from errors (Frese and Keith, 2015; Zhao, 2011). This study focuses on perceived contextual conditions. Particularly, we study how perceived trainer responses to trainee errors influence trainee learning from errors at the workplace. Our focus on the responses of trainers is justified by the key role supervisors or trainers play in affecting employees' emotions and learning as revealed in prior research (Edmondson, 1996, 1999). Research in this direction can enrich our understanding regarding what trainers should or should not do to foster trainee learning from errors, especially so in on-the-job training programs. Despite the best effort and commitment, errors cannot be completely eliminated from work due to human fallibility, and this statement applies even more to the situation of trainees who are still at an early stage of professional development. Unfortunately, oftentimes the way errors are dealt with during on-the-job training is less than optimal. Trainers' maladaptive and negative strategies toward errors can greatly impair trainee learning from errors (Cattaneo and Boldrini, 2017). As a result, trainees' subsequent work performance and career success will suffer because they fail to acquire all the critical occupational skills and knowledge required for succeeding on their jobs. Another related potential problem is that apprenticeship satisfaction will be dampened and dropout rates will run high among trainees (Baumgartner and Seifried, 2014; Negrini *et al.*, 2016). Therefore, there is a need to study the relationship between perceived trainer responses to errors and trainee learning in both academic and practical terms.

Yet, this study goes above mainly focusing on the direct relationship between perceived trainer responses and trainee learning from errors by studying the mediating role of affective-motivational adaptivity. Affective-motivational adaptivity is defined as "the degree to which the learner maintains positive affect (e.g. joy) and motivation to learn in the face of errors" (Steuer *et al.*, 2013, p. 197). The mediating role of affective-motivational adaptivity is supported by affective events theory, proposing that affective responses to workplace events mediate the relationship between these events and cognitive and behavioral responses (Weiss and Beal, 2005; Weiss and Cropanzano, 1996). Also, the learning and training literature has suggested that a pre-condition for learning from errors is that, despite setback and failure, individuals still feel motivated to learn (Bower, 1992; Kluger and DeNisi, 1996).

Finally, this study takes into account that the trainee-trainer interaction takes place within an organizational context that might further affect trainees' learning from errors. Particularly, we focus on how error climate (Frese and Keith, 2015; van Dyck *et al.*, 2005), that is, shared implicit and/or explicit norms, practices, and procedures for dealing with errors within an organization (Frese and Keith, 2015; Keith and Frese, 2011; van Dyck *et al.*, 2005), moderates the relationship between perceived trainers' responses and trainees' affective and motivational reactions.

Study 1: hypotheses

Our research builds on Tynjälä's (2013) 3P model of workplace learning (see also Billett, 1995, 2004). The model includes three main components: presage, process, and product. Presage refers to learner factors and workplace context (e.g. organizational structure), which influence learning process. Process refers to learning-related activities (e.g. reflecting on one's experience or seeking feedback from supervisors), and directly determines product. Product is the learning outcome (e.g. knowledge, skills, and abilities acquired as a result of engaging in learning). In this study, we focus on the first two components of the model: presage and process. In particular, we examine the link between perceived learning context and learning-related

activities and the mediating mechanism underlying this specific association. The mediating role of affective-motivational adaptivity is supported by affective events theory (Weiss and Beal, 2005; Weiss and Cropanzano, 1996) and by the learning and training literature suggesting that emotion and motivation are more proximate mechanisms of learning than individual differences and contextual factors (e.g. Chen *et al.*, 2000; Zhao, 2011).

Research has posited that immediate environmental characteristics, more than personality, influence affective and cognitive responses of human beings (Lazarus, 1991). We seek to explain the variance in trainees' affective-motivational responses by studying the role of trainer responses perceived by trainees. Literature on learning from errors has suggested that manager responses perceived by employees greatly affect whether individuals or teams will engage in discussion and analysis of errors, which is integral to reflective learning when confronting errors and setbacks (Edmondson, 2004). Trainers are a salient party in training programs and thus trainers' responses to errors can greatly affect trainees' affective, cognitive, and behavioral reactions to errors. Thus, we expect a strong association between trainer responses to errors and trainee learning. In the following section, we will discuss the hypotheses in detail.

The role of perceived trainer responses

To study the role of perceived trainer responses in trainees' learning from errors in on-the-job training programs, we consulted empirical research on learning from errors in schools (Baumgartner and Seifried, 2014; Pekrun, 2009). In particular, Steuer *et al.* (2013) examined how perceived error climate influences students' reactions and learning processes (the quantity and self-regulation of learner effort) in mathematics classrooms. In their study, four sub-dimensions of perceived error climate focus on teacher behavior: absence of negative reactions, error tolerance, teacher support following errors, and irrelevance of errors for grade. Referring to the study by Steuer *et al.* (2013), we investigate the role of trainers in workplace contexts by focusing on three of these sub-dimensions: negative reactions, error tolerance, and support following errors. We dropped the "irrelevance of errors for grade" sub-dimension because this only applies to classroom settings.

Our study extends the work of Steuer *et al.* (2013), as illustrated in the Discussion section. Also, we do not assume findings from classrooms generalize to on-the-job training in organizational settings. Errors at the workplace differ from those made in a classroom context in that they are associated with negative career-related consequences such as impaired professional image and even penalties. As a result, trainees at the workplace do not react in the same way to errors as pupils in a classroom.

Negative trainer reaction refers to the extent to which trainers exhibit negative reactions in response to a trainee's error, such as getting angry and annoyed and/or embarrassing the trainee in public. This blame-oriented approach does not encourage positive thinking and feeling toward errors, which, in turn, impairs the extent to which trainees enjoy their work or the work day during on-the-job training. The blaming approach promotes a fearful and divisive work environment where employees tend to respond defensively to errors and focus on image protection instead of learning from errors (Catino and Patriotta, 2013). In sum, negative trainer reaction impairs positive thinking and feeling about training and work, over time, trainees find it hard to enjoy work because they feel fearful and defensive (i.e. a negative association between negative trainer reaction and affective- motivational adaptivity).

Trainer tolerance of errors is about the extent to which trainers view errors as a normal part of the learning process, not something that should be avoided at all costs. Intolerance of errors reflects an error-avoidant training approach: trainees are prevented from making errors by receiving frequent corrective instructions throughout the training process (Frese and Keith, 2015). Research has shown that trainees learn from errors when trainers

take a positive view of errors and encourage trainees to learn through trial and error than when trainers focus on error avoidance in training (Heimbeck *et al.*, 2003; Keith and Frese, 2005). Tolerance of errors by salient parties, such as supervisors or trainers, helps trainees develop a positive mind-set toward errors, which is conducive to effective error management (Keith and Frese, 2005). After an error occurrence in a tolerant climate, trainees are able to concentrate on minimizing the negative consequences, such as decreased self-efficacy and dysfunctional thoughts and feelings; at the same time, they are capable of optimizing the positive consequences such as learning from errors (Keith and Frese, 2005; Zhao, 2011). Therefore, we expect that in on-the-job training programs, trainees are more likely to enjoy the training process and the work itself when trainers are tolerant of errors than otherwise (i.e. a positive link between perceived trainer tolerance of errors and affective-motivational adaptivity).

Trainer support following errors is defined as the extent to which trainers offer help and assistance (e.g. instructions) after trainees commit an error to facilitate learning. Learning from errors is an effortful activity that involves exploring ambiguity and uncertainty (Ohlsson, 1996; Zhao, 2011). For example, this effort requires purposeful reflection on, and analysis of, errors in order to improve task knowledge and skills (Ohlsson, 1996). Trainer support facilitates learning from errors by reducing the demand on trainees' cognitive resources and mitigating negative feelings, such as frustration and sadness. With trainer support, trainees are less likely to view the on-the-job training process as stressful and unpleasant and are more likely to maintain their interest and passion in their work (i.e. a positive link between perceived trainer support and affective-motivational adaptivity).

Finally, a positive link is expected between affective-motivational adaptivity and learning from errors. Affective-motivational adaptivity represents an adaptive response to errors: maintaining positive feeling and thinking about work. As mentioned earlier, learning from errors is an effortful and mindful activity that cannot occur without a motivational force. Although positive emotions have been found to promote learning from errors in educational psychology (e.g. Oades-Sese *et al.*, 2014; Pekrun *et al.*, 2011), organizational research has not explicitly examined the impact of positive affect as an affective mechanism that explains learning from errors in work settings.

Generally speaking, positive affect is associated with an approach behavioral tendency and a high level of persistent efforts in challenging achievement situations (George and Brief, 1996; Seo *et al.*, 2004). Therefore, we expect that trainees who remain positive and motivated about work after committing errors appreciate learning opportunities offered by errors and thus tend to focus on improving their task performance instead of getting defensive and engaging in dysfunctional image-protection activities (Catino and Patriotta, 2013). Where an employee's passion and intrinsic motivation toward work are not impaired by the negative event of error occurrence, distraction and withdrawal of cognitive resources is minimized. Also, when trainees enjoy work itself, they are more likely to interact with trainers in a pleasant and trustful way. The high-quality relationship makes it possible for trainees to get needed information through trustful discussion and information exchange in the social process of learning from errors (Carmeli and Gittell, 2009; Steuer *et al.*, 2013).

Affective events theory supports the mediating role of affective responses to workplace events in the association between these events and cognitive and behavioral responses (e.g. Weiss and Cropanzano, 1996). Therefore, integrating all the associations theorized in this section, we will study the mediating role of affective-motivational adaptivity in the link between perceived trainer responses and trainee learning from errors. We propose the following hypotheses:

H1. Affective-motivational adaptivity mediates the relationship between negative trainer reaction (a), trainer tolerance of errors (b) and trainer support (c), and trainee learning from errors.

Study 1: methods
Sampling
The sample consists of apprentices in the Swiss dual training system, which combines workplace on-the-job training with learning at vocational schools (Lewis, 2014). These training programs usually last between two and four years. During their apprenticeship, trainees are exposed to both classroom-based training in vocational schools and on-the-job training in a company where colleagues as well as professional trainers train the apprentices.

We recruited the participants by contacting vocational schools in Switzerland and inviting their trainees to participate in the survey. The participants completed the survey at their vocational schools during regular training sessions and the questionnaires were collected on site. All the items in the survey were framed to inquire about the part of training that takes place within companies. The language of the questionnaire was German.

Our sample comprised 225 apprentices from two training occupations: cooks ($n = 103$) and painters ($n = 122$). The sample was a convenient one; it was not selected out of a particular interest in studying training of these two occupations. Instead, our focus is on trainees' learning from errors in general. Nonetheless, research has found that painters evaluate their training quality more negatively than cooks (Negrini *et al.*, 2016). Therefore, it would be interesting to see if we can find any differences in the hypothesized associations between the two occupations. We excluded six observations because of the age of the apprentices (more than three SD above the mean). Also, we had missing data for five respondents. Therefore the final sample comprised 214 apprentices (cooks, $n = 119$; painters, $n = 95$). The mean age was 18.37 years (SD $= 2.28$), and 57.9 percent of the respondents were female.

Measures
To measure perceived trainer responses, we used an adaptation of the scale on "perceived error climate in the classroom" provided by Steuer *et al.* (2013). The original version consisted of eight dimensions, with four of them focusing on teacher behaviors. We excluded one of the four teacher-related dimensions: "irrelevance of errors for assessment," because it only applied to academic performance evaluation in a school context. As a result, we used all the other three dimensions focusing on teacher behaviors to assess perceived trainer responses in this study. We also modified the scales to better adapt them to the workplace context. Specifically, we replaced "teacher" by "trainer in our company" to reflect the context of company training. Respondents rated all items on a six-point scale from 1 (strongly disagree) to 6 (strongly agree).

Negative trainer reaction to errors. We used four items to measure perceived negative trainer reaction to errors. An example item is: "If someone in our company makes errors, the trainer often looks annoyed." The Cronbach's α indicated that the scale had a good internal consistency ($\alpha = 0.90$).

Trainer tolerance of errors. We used four items to measure perceived trainer tolerance of errors. An example item is: "In our company, errors are nothing bad for our trainer." The scale had a satisfactory internal consistency ($\alpha = 0.79$).

Trainer support following errors. Respondents' perception of trainer support following errors in the company was measured using four items. An example item is: "If someone in our company can't solve an assignment correctly, the trainer will help him." The reliability of the scale was good ($\alpha = 0.84$).

To measure how apprentices deal with errors, we used scales that were developed and applied in educational research (e.g. Grassinger and Dresel, 2017; Steuer *et al.*, 2013). The instrument consists of two components: affective-motivational adaptivity and learning from errors.

Affective-motivational adaptivity. This scale consists of five items. An example item is: "When I make an error in my company, work is less fun afterwards" (reverse coded). The reliability of the scale was satisfactory ($\alpha = 0.80$).

Learning from errors. Respondents' learning from errors was measured using seven items. An example item is: "When I can't do something in my company, I try even harder the next time." The reliability of the scale was good ($\alpha = 0.91$).

Control variables. We included three control variables in the analysis. First, we controlled for respondents' age (in years), because older people have been found to be more emotionally stable (Carstensen *et al.*, 2011) and thus less influenced by trainer reactions. Second, we controlled for respondents' gender, because men and women differ in their experience and expression of emotions (see, e.g. Simon and Nath, 2004). Third, we control for years of vocational training, as we expect that more experienced trainees may make fewer mistakes and thus may have a different emotional and motivational experience during on-the-job training.

Study 1: results
Table I shows the descriptive statistics, reliability coefficients, and correlations of the variables. We can see some high correlations between the trainer responses ($r > 0.54$). Yet, variance inflation factors (VIFs) indicated that multicollinearity is no severe problem ($\text{VIF}_{max} = 2.17$).

Measurement model and common method bias (CMB)
We conducted a confirmatory factor analysis (CFA) in MPlus 7.4 to verify our factor structure. The CFA indicated a reasonable model fit ($\chi^2 = 536.46$; $p < 0.001$; df $= 242$; $\chi^2/\text{df} = 2.21$; comparative fit index (CFI) $= 0.88$; Tucker-Lewis index (TLI) $= 0.86$; standardized root mean square residual (SRMR) $= 0.088$; root mean square error of approximation (RMSEA) $= 0.075$). All items loaded on the intended factor ($p < 0.001$), with factor loadings greater than 0.50. We compared the five-factor model with an alternative three-factor model (all trainer responses were merged) using the Satorra-Bentler scaled χ^2 difference test. The results indicate that the five-factor structure fits the data better ($\Delta\chi^2 = 278.34$; df $= 7$; $p < 0.001$).

We obtained all responses from a single key informant, because our study focuses on the link between trainees' perceptions of their trainers' responses to errors and trainee learning from errors, which may be difficult for an outsider to observe (e.g. the amount of cognitive effort put into learning). Nonetheless, this approach may cause problems of CMB. We took several steps before and during the study to reduce CMB, such as guaranteeing respondents that their responses would be treated confidentially and telling respondents that there are no right or wrong answers. We also performed statistical tests to estimate the effect of the CMB.

Variable	Mean	SD	1	2	3	4	5	6	7
1. Learning from errors	4.85	0.65	(0.91)						
2. Affective-motivational adaptivity	4.02	0.88	0.32	(0.80)					
3. Negative trainer reactions	2.64	1.23	−0.29	−0.45	(0.90)				
4. Trainer support following errors	4.42	0.97	0.50	0.39	−0.64	(0.84)			
5. Error tolerance by the trainer	3.74	0.98	0.26	0.29	−0.60	0.55	(0.79)		
6. Gender	0.58	0.50	0.04	−0.01	−0.11	0.07	0.15		
7. Age	18.36	2.27	0.13	−0.12	0.08	0.05	0.01	−0.04	
8. Years of vocational training	1.93	0.82	0.02	−0.16	0.06	−0.10	−0.14	0.07	0.43

Notes: $n = 213$. Coefficient αs are in parenthesis on the diagonal. All correlations greater than $|r = 0.14|$ are significant at $p < 0.05$

Table I.
Descriptive statistics and correlations (Study 1)

Particularly, we controlled for the influence of an unmeasured latent method factor (see Podsakoff *et al.*, 2003). We conducted a CFA in MPlus 7.4 and allowed all items to load on their respective construct and on a latent method factor. The model fitted the data poorly ($\chi^2 = 648.10$; $p < 0.001$; df $= 241$; χ^2/df $= 2.69$; CFI $= 0.83$; TLI $= 0.81$; SRMR $= 0.28$; RMSEA $= 0.088$). Also, the more parsimonious model, in which all items loaded only on their respective construct, fitted the data better ($p < 0.001$). The findings indicate that CMB is not a severe problem.

Structural model
We tested our hypotheses with structural equation modeling using MPlus 7.4. Structural equation modeling is suitable for analyzing our data because it accounts for potential measurement errors in the exogenous and endogenous variables (Lei and Wu, 2007). The structural model included indirect effects of the three perceived trainer responses on learning from errors via affective-motivational adaptivity, and a direct path from trainer responses to learning from errors. Fit indices indicated that the model provided a good fit to the data ($\chi^2 = 717.00$; $p < 0.001$; df $= 308$; χ^2/df $= 2.33$; CFI $= 0.87$; TLI $= 0.85$; SRMR $= 0.086$; RMSEA $= 0.079$). We found no evidence for differences in the parameters between the two occupational groups (χ^2difference (df: 17) $= 10.63$; $p = 0.88$).

We tested the mediating effects in a single model. The significance of the indirect effects was tested by calculating bias-corrected bootstrap confidence intervals (CI) with 1,000 random draws (see MacKinnon *et al.*, 2004). We interpreted the indirect effect as being statistically significant if the 95% CI around the indirect effects excluded 0.

H1a predicted that the relationship between negative trainer reaction and learning from errors is mediated by affective-motivational adaptivity. The indirect effect was −0.07 and the CI excluded 0 [CI: −0.16; −0.02]. Therefore, the hypothesis is supported.

H1b proposed that the relationship between trainer tolerance of errors and learning from errors is mediated by affective-motivational adaptivity. The hypothesis is not supported; the indirect effect was −0.02 and the CI included 0 [CI: −0.09; 0.01].

H1c stated that the relationship between trainer support and learning from errors is mediated by affective-motivational adaptivity. The hypothesis is not supported; the indirect effect was 0.02 and the CI included 0 [CI: −0.01; 0.08]. However, our results indicate a significant and positive direct relationship between trainer support and learning from errors ($b = 0.34$; $p < 0.001$).

Figure 1 summarizes the findings of Study 1. It is important to note than none of the control variables was significantly related to affective-motivational adaptivity and learning from errors ($p > 0.10$).

Study 1: discussion
The findings of Study 1 suggest that not all the trainer responses influence trainee learning from errors in the same way. Particularly, we found that negative trainer reaction impedes trainee learning from errors by impairing trainees' affective-motivational adaptability. Trainer tolerance of errors and trainer support following errors were not found to be related to trainee learning from errors via affective-motivational adaptability. However, we found a direct positive association between trainer support and trainee learning from errors.

In Study 2, we will explore these findings further using a different, larger sample. More importantly, Study 2 aims to provide refined insights into the conditions under which trainer responses are related to trainee learning from errors by testing whether the organizational context, particularly error climate, moderates the path between perceived trainer responses to errors and affective-motivational adaptability, thereby affecting trainee learning from errors.
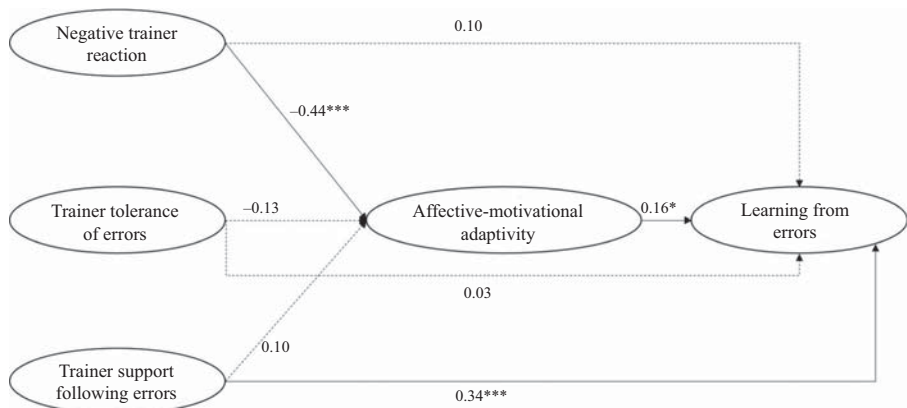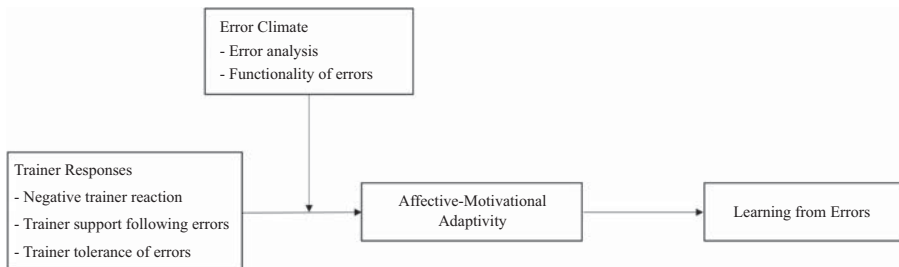
Figure 1.
Results of the
mediation analysis[a]

Notes: $n=213$. [a]Unstandardized coefficients are shown. $*p<0.05$; $**p<0.01$; $***p<0.001$ two-tailed tests

Study 2: hypotheses

Error climate has been suggested as a highly relevant context condition that influences employee responses to errors, including learning from errors (Frese and Keith, 2015; van Dyck *et al.*, 2005). A primary purpose for doing Study 2 is that we want to test the moderating role of perceived error climate in the link between perceived trainer responses and affective-motivational adaptability. It would be interesting to see how employees' emotional and behavioral responses are influenced when trainers exhibit attitudes or reactions consistent with (or contradicting) the organizational error climate as perceived by trainees. The moderating role of a facet-specific or focused climate such as perceived error climate is supported by organizational work climate literature (Kuenzi and Schminke, 2009).

Functionality of errors and error analysis were conceptualized and validated as the two "sub-dimensions" of perceived error climate, focusing specifically on the social processes of learning from errors in mathematics classrooms (Steuer *et al.*, 2013). We found these two dimensions highly relevant to studying trainees' learning from errors (as a social process between trainees and trainers) in the work setting. The hypothesized model is summarized in Figure 2. In the following section, we will discuss the hypotheses in detail.

Functionality of errors refers to the extent to which errors are used as opportunities for learning in an organization. Functionality of errors has been recognized as an important prerequisite for learning from errors in organizations (Frese and Keith, 2015; Rybowiak *et al.*, 1999; van Dyck *et al.*, 2005). A mind-set of acceptance of errors as learning opportunities views errors as signals suggesting that something needs to be done to fix the situation and motivates

Figure 2.
The hypothesized
model

adaptive changes in thinking and action (Frese and Keith, 2015). Error analysis describes the extent to which errors are discussed, analyzed, and examined in detail for performance improvement. Similar to functionality of errors, constructive communication about errors and error analyses (e.g. root cause analysis) have been proposed as enabling conditions for learning to occur (e.g. Carmeli and Gittell, 2009; van Dyck *et al.*, 2005). This may be especially true for employees who do not have all the needed knowledge and information to correctly identify the root cause of an error or to properly handle and control errors and the associated consequences.

Steuer *et al.* (2013) examined functionality of errors and error analysis as two sub-dimensions of a global construct called perceived error climate (in classrooms), and studied the direct influence of these two factors on the way pupils handled errors. We are interested in uncovering the moderating effects of these two dimensions of perceived error climate in an organizational setting. Particularly, it is important to understand how trainees will be affected when trainers display attitudes and behavioral reactions consistent with or in conflict with the perceived organizational error climate. We expect that when there is consistency, trainees will display more adaptive affective-motivational responses and more readily engage in learning from errors. When a trainer's responses contradict the perceived error climate, trainees will feel confused or unfairly treated by the trainer and thus will react in less adaptive ways (i.e. less affective-motivational adaptivity and less learning activity). We propose the following hypotheses:

H2a. Functionality of errors moderates the indirect effect of negative trainer reaction on learning from errors via affective-motivational adaptivity, such that the negative relationship between negative trainer reaction and affective-motivational adaptivity is weaker when functionality of errors is high than when functionality of errors is low.

H2b. Functionality of errors moderates the indirect effect of trainer tolerance of errors on learning from errors via affective-motivational adaptivity, such that the positive relationship between trainer tolerance of errors and affective-motivational adaptivity is stronger when functionality of errors is high than when functionality of errors is low.

H2c. Functionality of errors moderates the indirect effect of trainer support on learning from errors via affective-motivational adaptivity, such that the positive relationship between trainer support and affective-motivational adaptivity is stronger when functionality of errors is high than when functionality of errors is low.

H3a. Error analysis moderates the indirect effect of negative trainer reaction on learning from errors via affective-motivational adaptivity, such that the negative relationship between negative trainer reaction and affective-motivational adaptivity is weaker when error analysis is high than when error analysis is low.

H3b. Error analysis moderates the indirect effect of trainer tolerance of errors on learning from errors via affective-motivational adaptivity, such that the positive relationship between trainer tolerance of errors and affective-motivational adaptivity is stronger when error analysis is high than when error analysis is low.

H3c. Error analysis moderates the indirect effect of trainer support on learning from errors via affective-motivational adaptivity, such that the positive relationship between trainer support and affective-motivational adaptivity is stronger when error analysis is high than when error analysis is low.

Study 2: methods
Sampling
The sample consists of trainees in the German dual training system. The main features of the German dual training system are similar to the system in Switzerland. It also

combines workplace training with learning at vocational schools. These training programs usually last three years. The dropout rate is reported to be high (Baumgartner and Seifried, 2014).

We followed the same method for participant recruitment and on-site data collection as described in Study 1. Our sample comprised 1,012 apprentices from three training occupations: cooks ($n = 306$), commercial clerks ($n = 187$), and hotel and gastronomy ($n = 519$). The three occupations differ considerably regarding the working conditions. Particularly, the working conditions for apprentices in the hotel and gastronomy sector and for cooks are rather poor (e.g. low pay and long working hours), whereas commercial clerks experience more favorable conditions (Negrini *et al.*, 2016). Therefore, we will test to see if there is any difference in the hypothesized associations among the three occupations. The mean age of the respondents was 20.75 years (SD = 3.24) and 51.5 percent were female.

Similar to Study 1, we obtained all responses from a single key informant. However, this approach does not pose problems of CMB because Study 2 tests moderating hypotheses. As research has shown (Siemsen *et al.*, 2010), interaction effects cannot be artifacts of CMB, because CMB decreases the likelihood of detecting significant interactions.

Measures

We measured the three trainer responses and trainees' affective-motivational adaptivity and learning from errors using the same scales as described in Study 1. The reliability of the scales was satisfactory – negative trainer reactions: $\alpha = 0.87$; trainer tolerance: $\alpha = 0.80$; trainer support: $\alpha = 0.85$; affective-motivational adaptivity: $\alpha = 0.78$; and learning from errors: $\alpha = 0.82$.

We measured the moderator variables (error analysis and functionality of errors) by using an adaptation of the questionnaire "perceived error climate in the classroom" provided by Steuer *et al.* (2013). Referring to research on error climate in organizations (Rybowiak *et al.*, 1999; van Dyck *et al.*, 2005), we adapted and modified the items to fit the research context (on-the-job training within a company). We measured perceived error climate with an organizational referent (e.g. "In our company […]") because it reflects respondents' perceptions of their organizational environment instead of their personal experiences within the organization (Baltes *et al.*, 2009). Respondents rated all items on a six-point Likert scale from 1 (strongly disagree) to 6 (strongly agree).

Error analysis. We used four items to measure the perceived climate of error analysis. An example item is: "In our company, we discuss it in detail when something is done incorrectly." The reliability of the scale was good ($\alpha = 0.76$).

Functionality of errors. Perceived functionality of errors was measured using four items. An example item is: "In our company, errors trainees make are often used to make sure you really understand the matter." The reliability of the scale was acceptable ($\alpha = 0.64$).

Study 2: results

Table II shows the descriptive statistics, reliability coefficients, and correlations of the variables. We can see some high correlations between trainer responses ($r > 0.51$). Yet, VIFs indicated no serious problem with multicollinearity ($\text{VIF}_{\max} = 2.35$).

Measurement model

We conducted a CFA in MPlus 7.4 to verify our hypothesized factor structure. We tested the fit of our seven-factor model; the results indicate that the model fitted the data well ($\chi^2 = 1281.24$; $p < 0.001$; df = 443; $\chi^2/\text{df} = 2.89$; CFI = 0.92; TLI = 0.91; SRMR = 0.048; RMSEA = 0.043). All items loaded on the intended factor ($p < 0.001$); except for one item (factor loading = 0.48), all factor loadings were greater than 0.50. The Satorra-Bentler scaled

χ^2 difference test suggested that the hypothesized seven-factor model provided a better fit to the data than a five-factor model (all trainer responses were merged: $\Delta\chi^2 = 944.51$; df = 11; $p < 0.001$), a four-factor model (all error-related climates were additionally merged: $\Delta\chi^2 = 1,060.97$; df = 15; $p < 0.001$), and a three-factor model (learning from errors and affective-motivational reaction were additionally merged: $\Delta\chi^2 = 1,786.89$; df = 18; $p < 0.001$).

Structural model
In the first step, we tested the fit of the structural model using MPlus 7.4. Again, we used structural equation modeling to analyze data to account for potential measurement errors. It is important to note that our error climate construct refers to a psychological climate; that is, it represents a trainee's perception. Thus, the climate construct is measured and analyzed at the individual level (see, e.g. James *et al.*, 2008). The structural model included indirect effects of the three trainer responses on learning from errors via affective-motivational adaptivity, a direct path from trainer responses to learning from errors, and paths from the two error climates to affective-motivational adaptivity and learning from errors. Fit indices indicated that the structural model provided a good fit to the data ($\chi^2 = 1,556.81$; $p < 0.001$; df = 443; $\chi^2/df = 3.51$; CFI = 0.91; TLI = 0.90; SRMR = 0.048; RMSEA = 0.050). We also tested for differences in the structural parameters between the three occupational groups, but found no evidence for differences in the parameters (χ^2 difference (df: 34) = 38.17; $p = 0.29$). Therefore, we do not differentiate occupational groups in the model.

In the second step, we tested *H2a-H3c*, which posit that the error climate (functionality of errors and error analysis) moderates the indirect effect of trainer responses on learning from errors via affective-motivational adaptivity. To test this first-stage moderated mediation model, we followed Hayes (2015) and tested whether the index of moderated mediation – which quantifies the association between a moderator and an indirect effect – is different from 0. We used the reliability-corrected single-indicator latent moderated structural (RCSLMS) equations approach (Cheung and Lau, 2017). In the RCSLMS approach, all items belonging to a scale are combined into a single indicator; to account for measurement errors, the unique variances are fixed at (one-scale reliability) × indicator variance. To test the significance of the index of moderated mediation, we used the bias-corrected bootstrap CI method with 1,000 draws to calculate bias-corrected CIs for the index of moderated mediation. If the 95% CI excluded 0, we interpreted the index of moderated mediation as being statistically significant. We used Mplus 7.4 for the analysis.

The findings are summarized in Table III. We find evidence for three first-stage moderated mediation effects. First, supporting *H2c*, we find that the functionality of errors moderates the indirect effect of trainer support on learning from errors via affective-motivational adaptivity (index of moderated mediation = 0.024; 95% CI [0.004; 0.05]). Figure 3 shows the interaction.

Variable	Mean	SD	1	2	3	4	5	6	7
1. Learning from errors	4.70	0.65	(0.82)						
2. Affective-motivational adaptivity	3.86	0.95	0.27	(0.78)					
3. Negative trainer reaction	3.04	1.30	−0.17	−0.34	(0.87)				
4. Trainer support following errors	4.11	1.10	0.34	0.31	−0.65	(0.85)			
5. Error tolerance by the trainer	3.33	1.12	0.13	0.28	−0.58	0.51	(0.80)		
6. Error analysis	3.78	0.98	0.32	0.18	−0.32	0.53	0.26	(0.76)	
7. Functionality of errors	3.81	0.89	0.34	0.18	−0.28	0.46	0.39	0.52	(0.64)

Notes: $n = 1,012$. Coefficient alphas are in parenthesis on the diagonal. All correlations are significant at $p < 0.05$

Table II.
Descriptive statistics
and correlations
(Study 2)

Interaction effect		Index of moderated mediation	95% CI [LL; HL]	Indirect effect at	
				Low levels of moderator (−1SD)	High levels of moderator (+1SD)
Negative trainer reaction to errors × functionality of errors for learning	H2a	−0.016	[−0.040; 0.002]	−0.018	−0.041
Trainer support following errors × functionality of errors for learning	H2b	0.026	[0.006; 0.053]	0.008	0.045
Error tolerance by the trainer × functionality of errors for learning	H2c	0.017	[−0.005; 0.049]	0.000	0.024
Negative trainer reaction to errors × error analysis	H3a	−0.017	[−0.037; −0.003]	−0.015	−0.044
Trainer support following errors × error analysis	H3b	0.023	[0.008; 0.045]	0.007	0.046
Error tolerance by the trainer × error analysis	H3c	0.015	[−0.001; 0.039]	−0.001	0.025

Table III.
Results of moderated mediation analyses (Study 2)
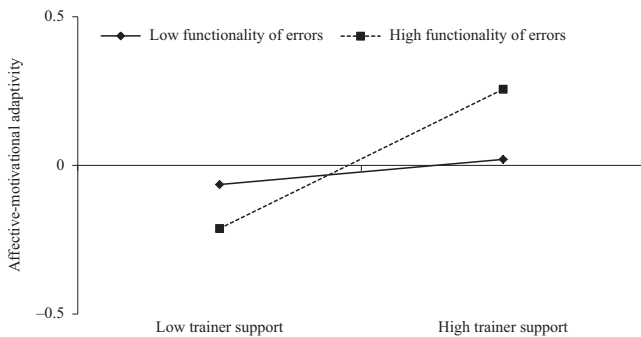
Figure 3.
Moderating effect of functionality of errors on the relationship between trainer support following errors and affective-motivational adaptivity

At low levels of functionality of errors, the relationship between trainer support and affective-motivational adaptivity is almost zero. Yet, at high levels of functionality of errors, we can see a positive relationship between trainer support and the affective-motivational adaptivity. The finding suggests that affective-motivational adaptivity mediates the relationship between trainer support and learning from errors only at high levels of perceived functionality of errors.

Second, supporting *H3a*, we find that error analysis moderates the indirect effect of negative trainer reaction on learning from errors via affective-motivational adaptivity (index of moderated mediation = −0.017; 95% CI [−0.037; −0.003]). As shown in Figure 4, the relationship between negative trainer reaction and affective-motivational adaptivity is always negative, but it is more negative when error analysis is high than when it is low. The finding indicates that affective-motivational adaptivity mediates the relationship between negative trainer reaction and learning from errors only at high levels of error analysis.

Third, supporting *H3c*, our analysis shows that error analysis moderates the indirect effect of trainer support on learning from errors via affective-motivational adaptivity (index of moderated mediation = 0.023; 95% CI [0.008; 0.045]). Figure 5 shows that the relationship between trainer support and affective-motivational adaptivity is always positive; yet, it is only slightly positive at low levels of error analysis, whereas it is more positive at high levels. The finding suggests that affective-motivational adaptivity mediates the relationship between trainer support and learning from errors at high levels of error analysis.

Study 2: discussion

The results of Study 2 suggest that perceived error climate is an important boundary condition that affects the relationship between perceived trainer responses and trainee learning from errors. Overall, the findings suggest that a fit is required between perceived trainer responses to errors and error climate in an organization to encourage trainees to engage in learning from their errors.

Discussion

Errors, as a form of negative performance feedback, can be de-motivating and discouraging, especially for employees who are still in the learning process. As Steuer *et al.* (2013, p. 196) put it: "Although making errors while learning is common, it is also frequently perceived as something negative, shameful and self-threatening." While it is commonly acknowledged that constructive instructions offered by trainers facilitate learning from errors (e.g. Frese and Keith, 2015; Heimbeck *et al.*, 2003), little research has been done to examine how perceived trainer responses affect trainee learning from errors in an organizational context. Findings of this study have important implications for research and managerial practice.

Theoretical contributions

This study contributes to research on learning from errors in three ways. First, findings from this study enrich our understanding regarding the role of trainers in enhancing learning from errors in an organizational context. Our study shows that the extent to which trainees engage in learning from errors is affected by perceived trainer responses to errors, suggesting that trainers' attitudes and beliefs regarding errors play a crucial role in trainee
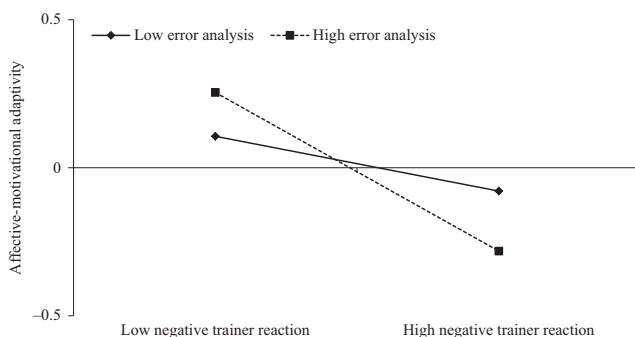
Figure 4.
Moderating effect of error analysis on the relationship between negative trainer reaction and affective-motivational adaptivity
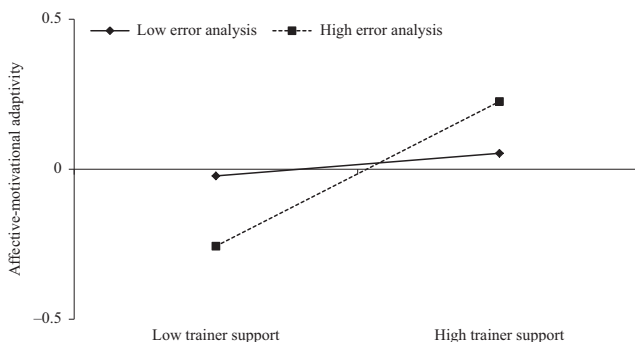
Figure 5.
Moderating effect of error analysis on the relationship between trainer support following errors and affective-motivational adaptivity

learning from errors. Our study complements prior work examining how trainers promote learning from errors via effective training approaches (e.g. Keith and Frese, 2008). The direct positive association between trainer support and trainee learning from errors suggests that trainer support in the form of assistance and explanations directly contributes to trainees' engagement in learning activities. The unexpected finding (Study 2) that a trainer's tolerance of errors is negatively related to trainee learning stimulates interesting speculations. This finding reminds us that simply being tolerant of errors and letting employees know that "it is OK to make mistakes" does not promote learning. Rather, high trainer tolerance of errors may actually impede learning, which suggests the importance of holding employees accountable for errors (Ron *et al.*, 2006). Nonetheless, holding employees accountable is not equal to blaming them, as revealed by our finding regarding the mediating role of negative trainer reactions, which were negatively associated with learning from errors via decreased affective-motivational adaptivity.

Second, our study extends research on learning from errors by investigating the interaction effects between perceived trainer responses and error climate, which has been acknowledged but not been studied in prior work (e.g. Frese and Keith, 2015; Lei *et al.*, 2016). Different from Steuer *et al.* (2013), who treated perceived teacher responses as sub-dimensions of error climate, we treat teacher responses and error climate as two distinct contextual factors and hypothesized that functionality of errors and error analysis (two dimensions of error climate) moderate the link between perceived trainer responses and trainees' affective and motivational reactions to errors and found partial support for this set of hypotheses. Besides supporting the moderating role of a focused climate, our findings confirm the need to explore the nuances involved in the dynamics associated with facet-specific climates, as suggested in research on organizational work climate (Kuenzi and Schminke, 2009).

Third, this study refines our knowledge of the role of positive affect in learning from errors in the work setting of on-the-job training by exploring the link between positive feelings and learning from errors. Whether employees learn from errors is largely determined by how they react to errors, including affective responses (Frese and Keith, 2015). Findings from this study confirm the mediating role of emotional responses suggested in the affective events theory (e.g. Weiss and Cropanzano, 1996). Also, our finding that trainees engage in learning from errors when they remain positive both emotionally and motivationally is consistent with the literature on emotions: positive affect is related to persistent efforts in challenging achievement situations (George and Brief, 1996; Seo *et al.*, 2004). Last but not least, results of this study contribute to the knowledge of the affective mechanisms that explain learning from errors by focusing on positive emotions and complementing prior work on the role of negative emotions in learning from errors in organizations (e.g. Zhao, 2011).

Managerial implications

For trainers and managers alike, a relatively complete picture emerges when we combine our findings regarding the three types of trainer responses to errors. Holding employees accountable for errors is based on the understanding that errors offer opportunities to learn, not to "point fingers." To encourage constructive learning-oriented perspectives toward errors, trainers and managers need to make it clear that employees have the major responsibility for their own on-the-job learning. Trainers and managers can support employee learning by offering feedback and assistance, without exhibiting negative responses to errors. Yet, if trainers and managers interpret "encouraging positive view towards errors" simplistically as being tolerant of errors, they may actually discourage learning from errors. Employees may be misled to believe that errors are not worth reflective thinking and analysis and thus not feel any pressure to learn.

Our findings regarding the moderating role of perceived error climate also offer useful and relevant insights to trainers and managers. An important takeaway message is that to promote learning from errors among trainees, organizations have to take care of both trainer responses and error climate to make sure that there is consistency between these two contextual factors. Learning from errors will be impaired if trainers respond to trainee errors in ways that are incompatible with the perceived norms and practices supporting functionality and analysis of errors within the organization. For instance, organizations might introduce regular meetings in which trainees discuss and analyze errors to facilitate learning. However, if trainers always exhibit negative reactions to errors, trainees will not feel motivated to engage in these learning activities.

Limitations
We collected data from apprentices of vocational schools in Switzerland and Germany, inquiring them about their on-the-job training experience. A potential limitation is that we only examined positive affect. Errors often evoke negative emotions that distract employees from learning (Zhao and Olivera, 2006). It would be interesting to examine both positive and negative emotions experienced in an error situation in one model and see how the two types of emotions affect learning from errors. Are there any interaction effects or do they have a combined influence on learning from errors by acting as a global emotionality? Is there any difference in the effects of discrete negative (e.g. guilt, shame, fear) or positive emotions (e.g. hope, pride)? All these questions present promising agendas for future research.

Also, we collected all the data from the same individual, which might result in CMB. However, it is unlikely that our findings are biased by CMB for several reasons: first, as discussed in Study 2, research suggests that CMB has little influence in complex models that include interaction effects (Siemsen *et al.*, 2010). Second, following recommendations offered by Podsakoff *et al.* (2003), in Study 1 we performed statistical tests to estimate the effect of the bias and the results suggest that CMB is not a significant problem. Nevertheless, we recommend that future research should collect data from multiple sources (e.g. trainees and trainers) to avoid such problems.

Finally, our two samples comprised trainees from four different occupation groups (i.e. painters, cooks, commercial clerks, and trainees in hotel and gastronomy). The fact that our data were collected from a limited set of occupations raises the potential concern regarding the generalizability of our findings. Although we cannot entirely rule out the possibility that our findings may vary by occupation, we deem it highly unlikely because as noted earlier in both Studies 1 and 2, statistical tests provided no evidence for any difference in the hypothesized relationships between different occupations examined in both studies. These results suggest that the generalizability of our findings to other occupations is not a substantial issue of concern.

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