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Maintaining the impact of action-oriented entrepreneurship training: the role of error mastery orientation for training transfer in an active learning setting

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ABSTRACT

Action-oriented entrepreneurship training can boost entrepreneurship, but positive short-term effects often decay over time. Based on training transfer theory, we argue that error mastery orientation is a personal characteristic that affects the maintenance of training outcomes over time in the transfer context of entrepreneurship. We implemented an action-oriented entrepreneurship training at a university in Uganda and collected data from training participants before ($N_{T0} = 175$) and after the training programme ($N_{T1} = 164$) as well as at a 1-year follow-up measurement ($N_{T2} = 52$). Growth curve models showed that the participants experienced an increase in entrepreneurial action and new venture creation over time. Furthermore, error mastery orientation influenced the maintenance of entrepreneurial action and new venture creation over time. The study contributes to theories of entrepreneurship training and training transfer by demonstrating that error mastery orientation is a boundary condition of the long-term effectiveness of active learning interventions, such as action-oriented entrepreneurship training.

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Action; business creation; error orientation; new venture; training transfer

Action-oriented entrepreneurship training is an effective means to promote entrepreneurship (Bohlayer & Gielnik, 2023; Carpenter & Wilson, 2022; Weers & Gielnik, 2021). During action-oriented entrepreneurship training, participants learn by actively engaging in the entrepreneurial process and practicing actions that correspond to start-up activities performed by entrepreneurs in real-world settings (Edelman et al., 2008; Frese et al., 2016). For example, training participants identify business opportunities, produce a new product or service, and sometimes create a new venture to introduce the new product or service into the market. The reason why action-oriented entrepreneurship training effectively promotes entrepreneurship is that active learning positively affects short-term learning outcomes in terms of enhanced knowledge, skills, and task motivation (Bell & Kozlowski, 2008; Freeman et al., 2014). Furthermore, the correspondence between the training and real-world setting increases the likelihood that participants transfer the short-term learning outcomes to the entrepreneurship context in the long term (Baldwin & Ford, 1988).

Although action-oriented entrepreneurship training has positive effects on short- and long-term outcomes (Bohlayer & Gielnik, 2023; Campos et al., 2017), research indicated that the positive effects often decay over time, similar to the decay of training effects in general (Blume et al., 2010; Ford et al., 2018). Specifically, evaluation studies of action-oriented entrepreneurship training programmes showed that short-term learning and performance effects were not maintained over time (e.g., Ubfal et al., 2022). Moreover, some participants of action-oriented entrepreneurship training experienced a boost in knowledge and motivation, but returned to their pre-training levels in the long run (Bilal & Fatima, 2022; Gielnik et al., 2017; Mensmann & Frese, 2019). A critical question therefore is why some participants of action-oriented entrepreneurship training experience a decay over time, whereas others maintain the short-term learning outcomes and eventually become entrepreneurs. Unfortunately, the theoretical understanding of the maintenance of short-term learning outcomes is still limited, and the question of who maintains short-term training outcomes over time therefore remains largely unanswered (Weers & Gielnik, 2021).

The theory of training transfer provides a general framework to understand the decay or maintenance of training outcomes (Baldwin & Ford, 1988; Ford et al., 2018). According to the theory, training transfer "is defined as the degree to which trainees effectively apply the knowledge, skills, and attitudes gained in a training context to the job" and it is a function of three factors: training design, personal characteristics, and the work context (Baldwin & Ford, 1988, p. 63). Training design involves principles of learning and the training content; personal characteristics refer to the participants' abilities, personality, and motivation; and the work context includes characteristics of the work environment as well as opportunities to apply the learned behaviours. Meta-analytic evidence provided support for the validity of the theory and showed that the three factors explain a considerable amount of variance in the maintenance of training outcomes over time (Blume et al., 2010).

Building on training transfer theory, we theorize that error mastery orientation is a personal characteristic that explains why some participants maintain training outcomes over time after action-oriented entrepreneurship training whereas others do not. Error mastery orientation reflects people's approach towards dealing with errors and deviations from a set standard

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(Rybowiak et al., 1999; van Dyck et al., 2010). Research demonstrated that error mastery orientation facilitates learning processes during action-oriented entrepreneurship training (Bohlayer & Gielnik, 2023; Eller et al., 2022; Funken et al., 2020). The theoretical reasoning is that action-oriented entrepreneurship training is a training context in which participants experience problems, errors, and deviations from the original business idea or model (Frese et al., 2016). Accordingly, error mastery orientation, which captures people's positive and constructive handling of such situations, increases the likelihood that participants benefit from action-oriented entrepreneurship training. In this study, we go beyond the learning processes during action-oriented entrepreneurship training and argue that error mastery orientation plays a similarly important role for the processes facilitating long-term training transfer after action-oriented entrepreneurship training. Specifically, we posit that the work context of entrepreneurship is characterized by making errors and deviating from the initial idea. In this context, error mastery orientation is a personal characteristic that facilitates applying and maintaining the learning outcomes of entrepreneurship training over time.

We seek to contribute to the literature in two ways. First, we contribute to the entrepreneurship training literature by theorizing error mastery orientation as a factor that explains the conditions under which participants of action-oriented entrepreneurship training are more likely to maintain short-term learning outcomes over time (Figure 1). So far, the main focus of the research in this field was on testing whether or not entrepreneurship training in general and action-oriented training in particular is effective (Bae et al., 2014; Carpenter & Wilson, 2022; Martin et al., 2013). Recently, the focus shifted to explaining why and for whom it works over time to ultimately result in new venture creation and higher performance (Bilal & Fatima, 2022; Bischoff et al., 2020; Mensmann & Frese, 2019). We contribute to the recent shift by modelling transfer maintenance curves of training outcomes as a function of error mastery orientation. Specifically, we show that error mastery orientation increases participants' likelihood to maintain a high level of entrepreneurial action over time, which ultimately explains why they are more successful in new venture creation 1 year after the training intervention. We thus contribute to developing a theory of entrepreneurship training that explains for whom long-term benefits of action-oriented entrepreneurship training can be expected (Martin et al., 2013; Weers & Gielnik, 2021).

Second, we contribute to the general training transfer literature by presenting error mastery orientation as an important personal characteristic that influences long-term training transfer in the context of active learning. Reviews of the training transfer literature suggest that the field has not yet widely considered error mastery orientation as a relevant personal characteristic in theoretical models explaining training transfer (Blume et al., 2010; Ford et al., 2018; Kraiger & Ford, 2021). We demonstrate that error mastery orientation positively influences long-term transfer in the context of action-oriented entrepreneurship training, thus constituting a relevant boundary condition of active learning approaches.

Error mastery orientation maintains the impact of action-oriented entrepreneurship training over time

Action-oriented entrepreneurship training is a training method that builds on principles of active learning to ultimately promote entrepreneurial action and new venture creation. In

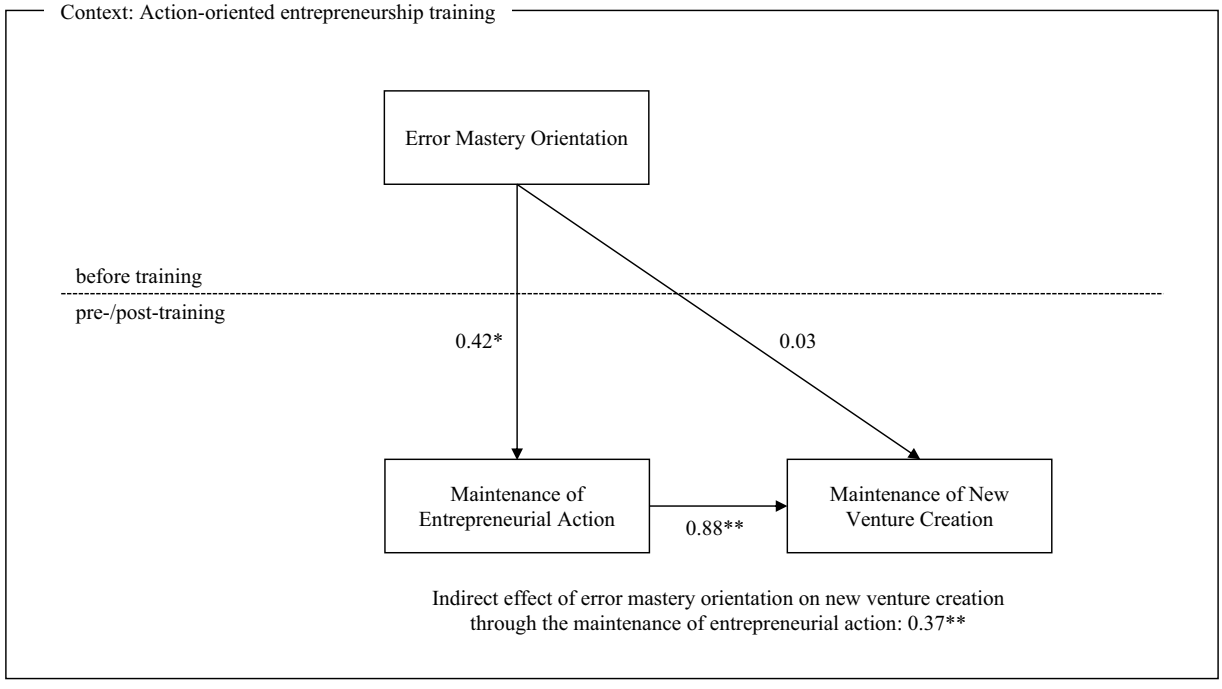

Figure 1. Dynamic mediated model showing how error mastery orientation promotes new venture creation by facilitating the maintenance of entrepreneurial action over time in the context of action-oriented entrepreneurship training.

general, active learning involves elements of control and exploration to foster learning (Bell & Kozlowski, 2008). The training participants have control by setting goals and monitoring their progress during training. Furthermore, the training participants actively explore the training content by engaging in and experimenting with the training tasks. Entrepreneurship training that includes elements of active learning typically features engagement in start-up activities along the process of new venture creation. For example, the training participants generate business ideas, develop a prototype and improve it based on feedback from customers, work on a business model, acquire resources, and eventually launch a new product or service by creating a new venture. The underlying principle is that training participants actively engage in exercises to work on a business idea in a setting that provides a (quasi-)realistic experience or high fidelity simulation of starting and managing a real new venture (Bohlayer & Gielnik, 2023; Weers & Gielnik, 2021). Theories of training and training transfer suggest that the active learning approach and the correspondence between the training and transfer setting facilitate learning and transfer (Bell & Kozlowski, 2008; Ford et al., 2018; Kraiger & Ford, 2021). Indeed, research demonstrated that action-oriented entrepreneurship training has positive short- and long-term effects on entrepreneurial action in terms of performing start-up activities (Gielnik et al., 2015) and new venture creation in terms of starting and managing a new business (Campos et al., 2017; Frese et al., 2016). Accordingly, we argue that training participants benefit from action-oriented entrepreneurship training and show an increase in entrepreneurial action and new venture creation after training.

Hypothesis 1: Participants' entrepreneurial action and new venture creation increase from before to after action-oriented entrepreneurship training.

However, action-oriented entrepreneurship training faces a transfer problem, similar to training programmes in general. Behaviour learned during training is not maintained over time or the maintenance is conditional on personal and contextual characteristics (Baldwin & Ford, 1988). For example, research showed that the maintenance of entrepreneurial behaviour over a 20-month period after training was dependent on the personal characteristic of deliberate practice, which refers to individualized and self-regulated activities to improve one's performance (Bilal & Fatima, 2022). Similarly, entrepreneurs were more likely to maintain a high level of personal initiative (i.e., self-started, proactive, and persistent behaviour) 25 months after training when their personal characteristic of need for cognition (i.e., the tendency to engage in and enjoy cognitive activities) was high (Mensmann & Frese, 2019).

In this study, we focus on the personal characteristic of error mastery orientation. People high in error mastery orientation have a positive attitude towards errors and perceive errors to be inevitable and a source for learning. In contrast, people low in error mastery orientation seek to prevent and avoid errors because they fear the negative consequences of errors (Rybowiak et al., 1999; van Dyck et al., 2010). Error mastery orientation has several positive cognitive and emotional functions. For example, error mastery orientation is related to perceiving and tolerating errors, thereby facilitating the cognitive processing of errors. People high in error mastery orientation are more likely to remain focused on the task when errors occur and they use their cognitive resources to reflect on the causes of the error (Dimitrova et al., 2015; Keith & Frese, 2005). For them, errors provide feedback and information that can be used as input for reflective thinking to systematically learn, innovate, mitigate problems, and improve the performance (Cowley et al., 2021; Uy et al., 2024; van Dyck et al., 2010). Furthermore, error mastery orientation facilitates the downregulation of negative emotions that arise after an error occurred. By framing errors as something positive, people high in error mastery orientation experience less strain and can alleviate feelings of worry, fear, or doubt that result from making errors. As a consequence, they are likely to remain motivated and confident to succeed in their endeavours (Bohlayer & Gielnik, 2023; Dimitrova et al., 2017). Indeed, research demonstrated that high error mastery orientation is beneficial in the context of entrepreneurs (e.g., Funken et al., 2020; Uy et al., 2024) and employees (e.g., Dimitrova & van Hooft, 2021; Horvath et al., 2021; Keith et al., 2020). Moreover, error mastery orientation has positive effects beyond the individual level and positively influences performance and safety in teams (Fruhen & Keith, 2014; Hofmann & Mark, 2006; Horvath et al., 2023) as well as learning, performance, and innovativeness of organizations (Fischer et al., 2018; Lei et al., 2016; van Dyck et al., 2005).

Action-oriented entrepreneurship training can trigger the process of new venture creation by prompting training participants to create a venture during the training programme. After training, the participants need to maintain the learned behaviour to successfully perform in the transfer setting. In this regard, we argue that error mastery orientation explains why training participants maintain the learned behaviour and are successful in new venture creation over time after action-oriented entrepreneurship training. Error mastery orientation enhances training transfer, in particular in transfer settings where participants constantly need to adjust established procedures or learn new ones to respond to changing circumstances (Ivancic & Hesketh, 2000; Keith & Frese, 2005; Smith et al., 1997). We argue that entrepreneurship is such a transfer setting, because it entails an iterative process during which entrepreneurs continuously adapt their business opportunity in response to feedback from customers until it can be successfully introduced into the market (Frese & Gielnik, 2023; McMullen & Dimov, 2013). Indeed, entrepreneurship begins with a rough idea for a product or service and then involves continuous experimentation and testing of the idea to develop it into a viable business opportunity (Dyer et al., 2008; Kirtley et al., 2022). The continuous experimentation and developing of the idea has been referred to as pivoting, which involves incrementally changing or radically redefining the business opportunity (Blank, 2013; Shepherd & Gruber, 2021). In the process of pivoting, learning from negative feedback is critical, because negative feedback fosters deeper-level learning by challenging current assumptions and updating underlying beliefs (Frese, 2021; Shepherd et al., 2022). Negative feedback indicates that something is not correct and that one's actions, plans, or assumptions were erroneous (Zacher & Frese, 2018). For example, entrepreneurs might have had erroneous

assumptions about customers' preferences and developed a product with irrelevant features. Thus, entrepreneurship is characterized by making errors and frequently deviating from the original business idea. Critique and negative feedback from customers or other stakeholders help entrepreneurs to adjust their product and proceed in developing a successful business opportunity. To use and learn from the negative feedback, however, entrepreneurs need a positive attitude towards errors that enables them to embrace errors as an opportunity to develop instead of ignoring or withdrawing from the negative feedback (Marvel et al., 2020; Shepherd et al., 2022). Accordingly, entrepreneurship favours people with high error mastery orientation (Eller et al., 2022; Funken et al., 2020; Uy et al., 2024). Because error mastery orientation involves the belief that errors can be turned into something positive, entrepreneurs high in error mastery orientation are more likely to reflect on and learn from the negative feedback they experience as part of the entrepreneurial process. Moreover, they are better able to downregulate negative emotions and therefore dwell less on the negative emotions elicited by the negative feedback. According to our reasoning, error mastery orientation facilitates the process to create and maintain a new venture after training by increasing the likelihood that entrepreneurs deal constructively with negative feedback that is crucial to make progress in the transfer setting. Consequently, error mastery orientation helps entrepreneurs to minimize negative and maximize positive consequences, thereby increasing their likelihood to accomplish the entrepreneurial process and successfully create a new venture.

Hypothesis 2: Error mastery orientation facilitates participants' maintenance of new venture creation over time after action-oriented entrepreneurship training.

We further hypothesize that error mastery orientation facilitates the maintenance of entrepreneurial action after training, which mediates the effect of error mastery orientation on the maintenance of new venture creation over time. Entrepreneurial action refers to start-up activities to create a new business and is the main determinant of new venture creation (Frese & Gielnik, 2023). Indeed, research provided evidence for the central role of entrepreneurial action for new venture creation (Reynolds, 2007). To develop our hypothesis, we first argue that error mastery orientation maintains the increase in entrepreneurial action after training over time. We then argue that the maintenance of entrepreneurial action has a positive effect on new venture creation and therefore serves as an explanation for why error mastery orientation facilitates the maintenance of new venture creation over time after training.

Error mastery orientation maintains the increase in entrepreneurial action after training over time because of its positive cognitive and emotional functions. Entrepreneurship is a process characterized by experiencing errors, problems, and setbacks. In such contexts, error mastery orientation positively affects the capability to stay focused and direct the attention towards the task (Dimitrova et al., 2015). Error mastery orientation thus promotes task engagement and prevents becoming distracted. Moreover, error mastery orientation helps to control and reduce negative emotions that result from experiencing errors and setbacks (Dimitrova et al., 2017; Keith & Frese, 2005). Consequently, entrepreneurs high in error mastery orientation are less likely to be discouraged by errors and setbacks, and they are thus more likely to proceed with their entrepreneurial actions in the face of difficulties.

Furthermore, we argue that the maintenance of entrepreneurial action positively affects new venture creation. Entrepreneurial action that is maintained over time is critical for creating a new venture because new venture creation takes several months during which entrepreneurs have to engage in a multitude of start-up activities over extended periods of time (Reynolds, 2007). Indeed, research showed that entrepreneurs need to persistently and continuously engage in action to succeed in new venture creation by performing a high rate of start-up activities that are spread out over time (Lichtenstein et al., 2007). This is also true when training participants have created a venture as part of an action-oriented training programme. Maintaining a venture that has been initiated during action-oriented training still requires investing substantial efforts in the transfer setting to develop the initial venture into a fully operating business that is successful and competitive over extended periods of time. Thus, participants of action-oriented entrepreneurship training can invest some preliminary efforts into new venture creation during training, but the long-term maintenance depends on training participants' continuous engagement in the tasks of entrepreneurship in the transfer setting. The transfer setting is thus of critical importance to translate short-term training outcomes to long-term venture creation. Accordingly, the increase in entrepreneurial action that training participants experience after action-oriented entrepreneurship training needs to be maintained over time to result in new venture creation. In conclusion, we argue that error mastery orientation facilitates the maintenance of entrepreneurial action after training over time and the maintenance of entrepreneurial action positively affects new venture creation. Accordingly, we argue that error mastery orientation has an indirect effect on the maintenance of new venture creation through the maintenance of entrepreneurial action over time.

Hypothesis 3: After action-oriented entrepreneurship training, error mastery orientation facilitates the maintenance of entrepreneurial action over time, which mediates the positive effect of error mastery orientation on the maintenance of new venture creation over time.

Method

The action-oriented entrepreneurship training

We implemented an action-oriented entrepreneurship training programme that included elements of active learning in terms of control and exploration by prompting students to start their own entrepreneurial venture and engage in all steps of the entrepreneurial process. The training programme ran over a period of 12 weeks with weekly 3-hour sessions during which the training participants learned to start and manage a new venture. In the first session, the training participants

identified a business opportunity, assembled resources to implement the opportunity, and started a micro business to introduce the opportunity into the market. The micro business was a real business as the training participants sold their products or services to real customers to generate revenue streams. Examples of micro-businesses started by the training participants were producing or processing food (e.g., sweets, pastries, and agricultural products), cosmetics or printing service, and retailing (e.g., clothes and bags). The 12 sessions covered the areas of entrepreneurship, business administration, and psychology including the topics of business opportunity identification, action planning, leadership, marketing, and finding starting capital. In the sessions, the training participants learned evidence-based action principles that provided guidelines and heuristics ("rules-of-thumb") for engaging in entrepreneurship. For example, the session on action planning included action principles based on action regulation theory, which explained how to form action plans (e.g., specifying when, where, and how to engage in action). During the session, the training participants also completed exercises related to their micro businesses (e.g., making financial projections for their business) and presented their results in the class.

Procedure and sample

We conducted a longitudinal study with one pre-training measurement (T0) and two post-training measurements. The first post-training measurement (T1) took place in the month after the training programme. The second post-training measurement (T2) took place 1 year after the training programme. We chose a time period of 1 year because new venture creation, which involves the organizing of new businesses, is a process that evolves over time (Davidsson & Gruenhagen, 2021; Gartner, 1985). Indeed, research showed that new venture creation and establishing a new business typically take several months to accomplish (Reynolds, 2007). Training participants were students enrolled at a university in Uganda. We informed the students through posters and announcements in lectures about the opportunity to attend the training programme. Students from all disciplines were allowed to participate in the training programme. The training programme was voluntary and an extracurricular course. Upon completion of the training programme, the participants received a certificate but no grades or course credits. In total, 176 students registered for the training and provided informed consent. On average, the students were in the second year of their studies ($M = 1.81$). Furthermore, 65% of the participants were female, 34% had entrepreneurial experience, 30% had attended a business course before, and 77% had a family member who owned a business.

We collected data using questionnaires administered in English at the three measurements (T0-T2). We collected data from 176 students at T0, from 165 students at T1, and 52 students at T2. Because of missing values, we could only use data from 175 students at T0 and from 164 students at T1, resulting in a total of 391 observations. We used the measures taken at T0 and performed *t*-tests and Fisher's exact tests to compare the respondents with non-respondents at T1 and T2, respectively. The tests revealed that respondents did not significantly differ from non-respondents at T1. Similarly, we did not find significant differences between respondents and non-respondents at T2, except for gender. The proportion of male participants was significantly higher in the group of non-respondents ($\hat{p} = .41$) than in the group of respondents ($\hat{p} = .21$, $p = .015$). In addition, Table 1 provides a comparison of the respondents across the three measurements. The respondents at T0 differed in gender from the respondents at T2 at the 10%-level ($\hat{p}_{T0} = .35$, $\hat{p}_{T2} = .21$, $\chi^2 = 3.12$, $p = .077$). To correct for a potential selection bias, we used the two-stage procedure using the inverse Mills ratio as a control variable in our analyses (Heckman, 1979). To compute the inverse Mills ratio, we used the total number of years studied at the university as an instrument in the selection equation. Specifically, we estimated the selection process with the binary outcome of responding/non-responding at T2 based on a probit regression with the explanatory variables of gender, family business ownership, entrepreneurial experience, error mastery orientation, and the instrument of total number of years studied at the university (see Hoke & Bendig, 2022). We assumed that the total number of years studied at the university would be negatively related to responding at T2 because the larger the total number of years studied, the more likely it was that the students graduated and moved to other regions where we could not locate them. Furthermore, we assumed that the total number of years studied at the university would not be related to the outcomes in terms of entrepreneurial action and new venture creation, because the students could engage in entrepreneurial action and new venture creation during or shortly after their studies (Clarysse et al., 2022). Indeed, the total number of years studied at the university was significantly related to responding at T2 ($B = -.22$, $p = .042$), but it was not related to entrepreneurial action ($B = -.07$, $p = .211$) or new venture creation ($B = .20$, $p = .204$), thereby fulfilling the requirements of an instrument. We note that our instrument reflects the total number of years studied at the university in a relatively homogeneous group of university students and not the total years of schooling in

Table 1. Comparison of means (M) and proportions ($\hat{p}$) of respondents across measurements.

	Respondents at T0		Respondents at T1		Respondents at T2		Comparison T0-T2		Comparison T1-T2	
	M/$\hat{p}$	SD	M/$\hat{p}$	SD	M/$\hat{p}$	SD	t/χ^2	p	t/χ^2	p
Year of studies	1.81	0.89	1.80	0.89	1.69	0.85	0.88	0.379	0.80	0.424
Error mastery orientation	3.87	0.56	3.87	0.57	3.94	0.51	0.85	0.398	0.84	0.404
Entrepreneurial action (T0)	1.33	0.86	1.33	0.85	1.19	0.63	1.29	0.201	1.28	0.205
Gender[a,b]	0.35		0.34		0.21		3.12	0.077	2.54	0.111
Business courses taken[a,c]	0.30		0.30		0.27		0.05	0.830	0.05	0.815
Entrepreneurial experience[a,c]	0.34		0.34		0.31		0.09	0.761	0.08	0.779
Family business ownership[a,c]	0.77		0.78		0.77		0.00	1.000	0.00	0.999
New venture creation (T0)[a,c]	0.18		0.18		0.13		0.36	0.548	0.35	0.552

[a]Proportion ($\hat{p}$) and Chi^2-statistic (χ^2) in case of binary variables; [b]0 = female, 1 = male; [c]0 = no, 1 = yes; $N_{T0} = 175$, $N_{T1} = 164$, $N_{T2} = 52$.

a heterogeneous group of people ranging from primary education to doctorate. This is an explanation why our instrument was not related to entrepreneurial action or new venture creation in contrast to previous findings (Davidsson & Honig, 2003; Unger et al., 2011).

Measures

Error mastery orientation

We measured error mastery orientation before the training programme (T0). In line with previous research (Bohlayer & Gielnik, 2023; Funken et al., 2020; van Dyck et al., 2010), we used the error orientation questionnaire by Rybowiak et al. (1999) with the five sub-dimensions of error competence, learning from errors, thinking about errors, error risk-taking, and error communication. The total scale consisted of 21 items. An example item was "After a mistake has happened, I think long and hard about how to correct it." We used a 5-point Likert scale ranging from "Not at all" to "Very much" to measure participants' responses. The internal consistency of the scale was Cronbach's alpha = .91. The observed scale range was between 2.14 and 5.00.

Entrepreneurial action

We measured entrepreneurial action at the three measurements (T0-T2) using the measure by Gielnik et al. (2015). We asked two filter questions ("Are you starting a new business at the moment?" and "Do you intend to start a new business within the next 12 months?"). When participants' answer was "yes" to one of the filter questions, they responded to 12 items about start-up activities they had invested effort in (e.g., "How much effort have you put into doing market research?"). We used a 5-point Likert scale ranging from "not at all" to "very much effort" to assess participants' responses. In case the participants' answer was "no" to both filter questions, they received a score of 1. Cronbach's alpha ranged between α = .88 and α = .94 across the three measurements. The observed scale range was between 1.00 and 5.00 at T0 and T1 and between 1.00 and 4.75 at T2.

New venture creation

We measured new venture creation at the three measurements (T0-T2) by asking the participants whether they were currently the owner of a business ("Are you currently the owner of a business?") with the response options of "yes" and "no". In case the participants reported to be a business owner, we validated their responses by asking them for the year they had started the business, the main product or service, the monthly sales and profits, and the number of full- and part-time employees.

Control variables

We measured the control variables at the first measurement (T0). We measured gender (0 = female, 1 = male), whether a family member was a business owner (0 = no, 1 = yes), and entrepreneurial experience. The measure of entrepreneurial experience captured whether the participants had ever started a business in the past or were currently the owner of a business (0 = no, 1 = yes). We controlled for gender, family business ownership, and entrepreneurial experience because of their effect on entrepreneurial action and new venture creation (Davidsson & Honig, 2003; Klapper & Parker, 2011).

Analytical procedure

We applied the analytical approach of dynamic mediation to test our theoretical model (Pitariu & Ployhart, 2010). Our theoretical model describes the effect of error mastery orientation on the maintenance of entrepreneurial action and new venture creation over time. Following the approach of dynamic mediation, we used growth curve modelling with random intercepts and tested whether error mastery orientation influenced the development of entrepreneurial action and new venture creation over time. In our models, the variable time reflected the three measurements (i.e., 0, 1, and 2). We modelled the development over time by including a linear term of time following the approach of dynamic mediation (Pitariu & Ployhart, 2010). Moreover, we included a squared term for time in our models for additional exploratory analyses, because transfer maintenance curves might be curvilinear as training outcomes oftentimes increase in the short term and decrease in the long term (Baldwin & Ford, 1988). We performed a generalized linear multi-level analysis with a logit link function when the outcome was the dichotomous variable of new venture creation. We grand-mean centred all predictor variables. We report conditional and marginal R^2 as indices of the explanatory power of the models (Nakagawa & Schielzeth, 2013).

Transparency and openness

The study was exempted from ethical review by the Research Commission of the first author's faculty because its research design fulfilled the faculty's criteria for exemption (e.g., informed consent, data protection, no harm or threat). The study design, hypotheses, and analysis plan were not preregistered. The data, research materials, and syntax of the statistical analyses are available from the authors upon request. We note that the sample overlaps with the sample reported by Funken et al. (2020). The overlap pertains only to the data collected at T0 and includes the control variables of gender, family business ownership, entrepreneurial experience, and the moderator variable of error mastery orientation. The data of entrepreneurial action and new venture creation at T0 and the data collected at T1 and T2 are unique and have not been reported elsewhere. We used the statistical software R with the packages lme4 and MuMIn to perform the analyses (Barton, 2022; Bates et al., 2015; R Core Team, 2023).

Results

Table 2 presents the descriptive statistics. The mean of entrepreneurial action before the training programme (T0) was M = 1.33. The means of entrepreneurial action after the training programme were M = 1.80 in the short term (T1) and M = 1.89 in the long term (T2). Paired t-tests showed that both the short-term (t = 3.86, p < .001) and the long-term increase in entrepreneurial action were significant (t = 3.18, p = .002). Similarly, we found significant increases in new venture creation from before ($\hat{p}_{T0}$ = .18) to after the training programme in the short term ($\hat{p}_{T1}$ = .39, χ^2 = 23.12, p < .001) and the long term ($\hat{p}_{T2}$ = .40, χ^2 = 9.80, p = .002). The results suggest that training participants increased in entrepreneurial action and new venture creation

Table 2. Descriptive statistics.

Variables	M/$\hat{p}$	SD	1	2	3	4	5	6	7	8	9
1. Error mastery orientation	3.87	0.56									
2. Entrepreneurial action (T0)	1.33	0.86	.05								
3. Entrepreneurial action (T1)	1.80	1.36	.22**	.05							
4. Entrepreneurial action (T2)	1.89	1.37	.32*	−.11	.36**						
5. New venture creation (T0)	0.18		.12	.36**	.04	.06					
6. New venture creation (T1)	0.39		.06	.14	.30**	.34**	.33**				
7. New venture creation (T2)	0.40		.39**	.00	.26	.66**	.13	.45**			
8. Gender[a,b]	0.35		−.06	−.03	.06	.03	.11	.08	.25		
9. Family business ownership[a,c]	0.77		.01	.13	.05	.09	.19**	.00	.17	−.05	
10. Entrepreneurial experience[a,c]	0.34		.11	.22**	.10	.08	.65**	.24**	.05	.04	.22**

[a]Proportion ($\hat{p}$) in case of binary variables; [b]0 = female, 1 = male; [c]0 = no, 1 = yes; $N_{T0} = 175$, $N_{T1} = 164$, $N_{T2} = 52$; *$p < .05$, **$p < .01$.

over time after the action-oriented entrepreneurship training programme. We note that our study does not include a control group. We therefore compared the increases in entrepreneurial action and new venture creation over time to the findings of previous evaluation studies that tested the effectiveness of an equivalent training programme by using a randomized control group design (Frese et al., 2016; Gielnik et al., 2015; Peschmann et al., 2023). The previous studies reported statistically significant short- and long-term effects of the training programme on entrepreneurial action and new venture creation. Furthermore, the effect sizes of the changes in entrepreneurial action and new venture creation over time in the training group of our study were similar to the effect sizes observed in previous studies. Specifically, we found effect sizes of changes in entrepreneurial action of $d = 0.42$ in the short term and $d = 0.56$ in the long term. The effect sizes were similar to effect sizes of $d = 0.30$ (short-term) and $d = 0.72$ (long-term) in the study by Gielnik et al. (2015). Moreover, our effect sizes of changes in new venture creation of $d = 0.48$ in the short term and $d = 0.53$ in the long term were similar to the effect sizes of $d = 0.80$ (short-term) and $d = 0.69$ (long-term) reported by Peschmann et al. (2023).

Test of hypotheses

Hypothesis 1 states that entrepreneurial action and new venture creation increase from before to after action-oriented entrepreneurship training. We performed growth curve analyses to test the hypothesis. Table 3 presents the results for new venture creation. Model 1 shows that the coefficient of time was positive and significant ($B = 1.38$, $p < .001$). Furthermore, the coefficient of time squared was negative and significant ($B = -0.74$, $p = .018$), suggesting that the increase in new venture creation over time was curvilinear. Table 4 presents the results for entrepreneurial action as the outcome variable. Model 1 shows that time had a positive and significant effect on entrepreneurial action ($B = 0.39$, $p < .001$). The coefficient of time squared was not significant ($B = -0.20$, $p = .104$). Overall, the significant coefficients of time for new venture creation and entrepreneurial action supported Hypothesis 1.

Hypothesis 2 states that error mastery orientation facilitates participants' maintenance of new venture creation over time after action-oriented entrepreneurship training. To test the hypothesis, we included error mastery orientation as a cross-level moderator of time (linear and squared) in the model. Model 2 in Table 3 presents the results. The results showed that the interaction term between error mastery orientation and time linear was not significant ($B = 0.03$, $p = .955$). Thus, Hypothesis 2 was not supported. As exploratory analyses, we included the interaction term between error mastery orientation and time squared in the model, which was significant ($B = 1.31$, $p = .037$). Figure 2 illustrates the significant interaction effect. We found a steady increase in new venture creation over time for participants higher in error mastery orientation (one SD above the mean), whereas participants lower in error mastery orientation (one SD below the mean) experienced a short-term increase and a long-term decrease in new venture creation over time.

Table 3. Growth curve models of the maintenance of new venture creation over time dependent on error mastery orientation.

	Model 1		Model 2		Model 3	
	New venture creation		New venture creation		New venture creation	
Variables	B	SE	B	SE	B	SE
Intercept	−1.42**	(0.24)	−1.46**	(0.24)	−1.60**	(0.28)
Inverse Mills ratio	−0.45	(0.94)	0.24	(1.01)	0.78	(1.10)
Gender[a]	0.96	(0.56)	0.70	(0.58)	0.49	(0.63)
Family business ownership	0.18	(0.46)	0.20	(0.46)	0.02	(0.51)
Entrepreneurial experience	2.49**	(0.48)	2.37**	(0.48)	2.43**	(0.53)
Time	1.38**	(0.28)	1.36**	(0.29)	1.17**	(0.31)
Time squared	−0.74*	(0.31)	−0.86**	(0.33)	−0.73*	(0.36)
Error mastery orientation			0.73	(0.39)	0.60	(0.43)
Time × Error mastery orientation			0.03	(0.49)	−0.43	(0.55)
Time squared × Error mastery orientation			1.31*	(0.63)	1.62*	(0.71)
Entrepreneurial action					0.88**	(0.18)
$R^2_{(marginal)}/R^2_{(conditional)}$	.30/.55		.33/.57		.43/.66	
Deviance (−2LL)	384.79		376.01		336.87	

Unstandardized coefficients are shown; [a]0 = female, 1 = male; $N = 391$ observations nested in 175 participants; *$p < .05$, **$p < .01$.

Table 4. Growth curve models of the maintenance of entrepreneurial action over time dependent on error mastery orientation.

	Model 1		Model 2	
	Entrepreneurial action		Entrepreneurial action	
Variables	B	SE	B	SE
Intercept	1.60**	(0.06)	1.60**	(0.06)
Inverse Mills ratio	−0.86**	(0.33)	−0.52	(0.35)
Gender[a]	0.43*	(0.19)	0.30	(0.20)
Family business ownership	0.17	(0.15)	0.17	(0.15)
Entrepreneurial experience	0.37**	(0.14)	0.31*	(0.14)
Time	0.39**	(0.09)	0.39**	(0.09)
Time squared	−0.20	(0.12)	−0.22	(0.12)
Error mastery orientation			0.28*	(0.12)
Time × Error mastery orientation			0.42*	(0.16)
Time squared × Error mastery orientation			−0.07	(0.23)
$R^2_{(marginal)}/R^2_{(conditional)}$	.08/.15		.11/.17	
Deviance (−2LL)	1,222.48		1,215.71	

Unstandardized coefficients are shown; [a]0 = female, 1 = male; $N = 391$ observations nested in 175 participants; *$p < .05$, **$p < .01$.

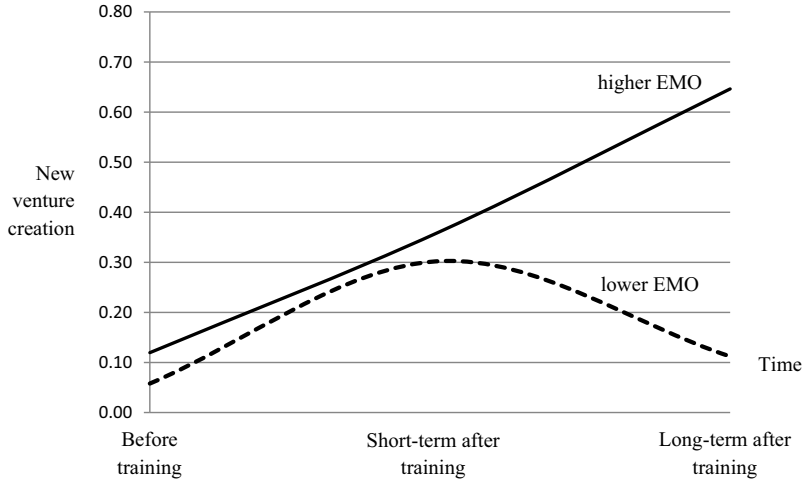

Figure 2. Transfer maintenance curves of new venture creation over time dependent on error mastery orientation (EMO).

Hypothesis 3 states that after action-oriented entrepreneurship training, error mastery orientation facilitates the maintenance of entrepreneurial action over time, which mediates the positive effect of error mastery orientation on the maintenance of new venture creation over time. We followed the logic of dynamic mediation to test the hypothesis (Pitariu & Ployhart, 2010). We tested whether error mastery orientation facilitated the maintenance of entrepreneurial action over time by including error mastery orientation as a cross-level moderator of time (linear and squared) in Model 2 of Table 4. Error mastery orientation moderated the effect of time linear on entrepreneurial action ($B = 0.42$, $p = .011$). The effect of error mastery orientation on time squared on entrepreneurial action was not significant ($B = -0.07$, $p = .775$). Figure 3 presents a graphical

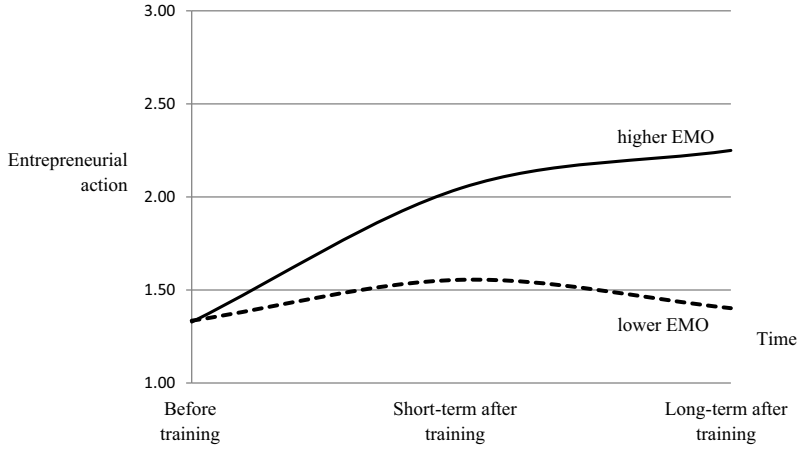

Figure 3. Transfer maintenance curves of entrepreneurial action over time dependent on error mastery orientation (EMO).

illustration of the significant interaction effect. The figure shows that entrepreneurial action increased in the short term and remained at a high level over time for participants higher in error mastery orientation (one SD above the mean). For participants lower in error mastery orientation (one SD below the mean), the short-term increase in entrepreneurial action was weaker and not maintained over time. Next, we included entrepreneurial action as a predictor of new venture creation in Model 3 of Table 3. The coefficient was positive and significant ($B = 0.88$, $p < .001$), suggesting that entrepreneurial action was positively related to new venture creation. Finally, we tested the indirect effect of error mastery orientation on new venture creation through the maintenance of entrepreneurial action by using the Monte Carlo method (Pitariu & Ployhart, 2010; Selig & Preacher, 2008). The indirect effect was positive and significant (indirect effect = 0.372, $p = .009$). The results supported Hypothesis 3.

Discussion

We theorized about the function of error mastery orientation for maintaining the positive effects of action-oriented entrepreneurship training on entrepreneurial action and new venture creation over time. The results supported our theoretical model. Error mastery orientation boosted and maintained entrepreneurial action over time. Furthermore, error mastery orientation had a positive effect on the maintenance of new venture creation over time through the maintenance of entrepreneurial action. Our findings contribute to the entrepreneurship training literature and the training transfer literature in general.

Theoretical and practical implications

We contribute to the entrepreneurship training literature by identifying error mastery orientation as a boundary condition of the long-term maintenance of training outcomes after action-oriented entrepreneurship training. The entrepreneurship training literature regards action-oriented entrepreneurship training with its elements of active and experiential learning as a promising avenue to promote entrepreneurship (Bohlayer & Gielnik, 2023; Campos et al., 2017; Carpenter & Wilson, 2022; Nabi et al., 2017). So far, the theoretical understanding of action-oriented entrepreneurship is mainly limited to the underlying mechanisms that explain why action-oriented entrepreneurship training positively influences short- and long-term outcomes. For example, research showed that cognitive, motivational, and self-regulatory factors are short-term outcomes that mediate the effect of action-oriented entrepreneurship training on long-term outcomes, such as venture creation and performance (Anderson et al., 2018; Bohlayer & Gielnik, 2023; Gielnik et al., 2015; Glaub et al., 2014). Yet, in addition to identifying the underlying mechanisms, examining the boundary conditions is critical to develop a comprehensive theoretical understanding of action-oriented entrepreneurship training. In this regard, we identified error mastery orientation as a personal characteristic that is relevant to understand the long-term maintenance of training outcomes in the transfer context of entrepreneurship. Our study suggests that the positive effect of action-oriented entrepreneurship training is not consistent across people. Rather, the long-term effectiveness depends on training participants' error mastery orientation, which influences how the participants apply and engage in the learned behaviour in the transfer setting. Error mastery orientation is important in the transfer setting of entrepreneurship, because it helps training participants to deal with errors, problems, and deviations that occur in the entrepreneurial process. Interestingly, other studies identified deliberate practice and need for cognition as factors facilitating the long-term maintenance of training outcomes after action-oriented entrepreneurship training (Bilal & Fatima, 2022; Mensmann & Frese, 2019). A common underlying theme across the different boundary conditions (error mastery orientation, deliberate practice, and need for cognition) is the willingness to invest effort into continuously learning and improving through reflection and analysing one's errors and shortcomings. Future research could build upon these insights to develop a theoretical framework that comprehensively describes the personal characteristics influencing the long-term maintenance of training outcomes of action-oriented entrepreneurship training in the transfer context of entrepreneurship. As part of this theoretical work, future research could also investigate the incremental validity of error mastery orientation, deliberate practice, and need for cognition and their interplay in facilitating the maintenance of training outcomes over time.

Our study makes a unique contribution to the literature compared to previous research that examined the role of error mastery orientation in action-oriented entrepreneurship training (e.g., Bohlayer & Gielnik, 2023; Eller et al., 2022; Funken et al., 2020). Whereas previous research examined the effect of error mastery orientation on processes that happen during training (i.e., within-training), our study examined the effect of error mastery orientation on the maintenance of training outcomes over time after training (i.e., post-training). The findings across the current and previous research consistently demonstrate that error mastery orientation positively influences trainees' learning and development. The set of studies thus provides a comprehensive perspective on the important role of error mastery orientation for within- and post-training processes of action-oriented entrepreneurship training.

We also contribute to the training transfer literature in general by identifying error mastery orientation as a factor facilitating the maintenance of training outcomes in an active learning setting, such as action-oriented entrepreneurship training. Active learning is an effective method to foster learning and skill development, not only in entrepreneurship but also in general (Bell & Kozlowski, 2008; Bell et al., 2017; Deslauriers et al., 2019; Freeman et al., 2014). Accordingly, active learning is a key element in theories of training and training transfer (Ford et al., 2018; Kraiger & Ford, 2021). However, the effect of active learning varies across people and for some training participants active learning is not beneficial. Indeed, research identified boundary conditions for the positive effects of active learning, such as training participants' age, cognitive ability, openness to experience, negative affectivity, and goal orientation (Carter & Beier, 2010; Chillarege et al., 2003; Gully et al., 2002; Heimbeck et al., 2003; Keith et al., 2020; Loh et al., 2013). Furthermore, research showed that active learning is particularly effective for

adaptive transfer, which involves applying the learned behaviour to new or changing circumstances by reconfiguring what has been learned, engaging in exploration, and developing new methods (Dormann & Frese, 1994; Keith & Frese, 2008; Smith et al., 1997; Wood et al., 2000). We contribute to this research by demonstrating that the personal characteristic of error mastery orientation is a boundary condition of training participants' transfer performance, facilitating the maintenance of training outcomes over time. Under circumstances of adaptive transfer that require people to take control and explore, errors are likely to occur and consequently, a positive handling of errors is helpful to perform in such contexts.

Finally, our study has practical relevance by showing that error mastery orientation is a boundary condition of the long-term impact of action-oriented training on training outcomes. Accordingly, trainers who use an action-oriented approach could enhance the effectiveness of their training by offering it to people high in error mastery orientation or by including elements in the training programme that foster error mastery orientation. Indeed, research showed that promoting a learning goal orientation and incorporating error management instructions into the training programme improved trainees' error handling and subsequent performance (Dimitrova et al., 2017; Heimbeck et al., 2003; van Dyck et al., 2010).

Limitations

Our study has the following limitations. First, we conducted our study in Uganda, which is a low-income country and in which the entrepreneurship rate is particularly high compared to other countries (Namatovu et al., 2011). Consequently, we assume that the positive effects of the action-oriented entrepreneurship training programme on entrepreneurial action and new venture creation might have been relatively more pronounced. However, we assume that the positive effect of error mastery orientation on the maintenance of entrepreneurial action and new venture creation over time holds also true in other contexts. Indeed, research with samples from more developed regions has demonstrated a positive effect of error mastery orientation on performance in settings similar to the transfer setting of entrepreneurship (Bledow et al., 2017; Frese & Keith, 2015; Keith & Frese, 2008). We further note that scholars have explicitly called for research in regions that are characterized by poverty, institutional instability, and infrastructural underdevelopment to develop theories that are generalizable to different contexts (Arnett, 2008; Kirkman & Law, 2005). Accordingly, our study based on a Ugandan sample helps to build a cumulative and representative body of research on error mastery orientation across different countries and contexts.

Second, we note that our sample consisted of university students. The generalizability of our findings is therefore limited to this subgroup of the general population. However, it is important to note that this subgroup is typically the main target group of entrepreneurship education and training (Bae et al., 2014; Martin et al., 2013). Fostering entrepreneurship among university students is an important means to promote opportunity-driven and high-growth entrepreneurship (van Stel et al., 2007). Furthermore, research provided evidence for the effectiveness of action-oriented entrepreneurship in other contexts and with other samples (Bilal & Fatima, 2022; Campos et al., 2017; Carpenter & Wilson, 2022; McKenzie, 2021; McKenzie et al., 2023). We therefore argue that our findings have important theoretical and practical implications, at least for entrepreneurs who have attained tertiary education and who are at the beginning of their entrepreneurial careers.

Third, we note that we used a pre-/post-test design without a control group to examine the effectiveness of the action-oriented entrepreneurship training. Therefore, we cannot rule out the alternative explanation that the increase in entrepreneurial action and new venture creation over time was due to the participants' maturation instead of the training programme. Ideally, evaluation studies should use randomized experiments with a control group to assess the impact of a training intervention (McKenzie, 2021; McKenzie et al., 2023). However, we compared our findings to the findings of similar evaluation studies that used a randomized control group design to demonstrate positive short- and long-term effects of the training programme on entrepreneurial action and new venture creation (Gielnik et al., 2015; Peschmann et al., 2023). The increases in entrepreneurial action and new venture creation over time that we observed in the current study were similar to the changes observed in the previous studies. We note that the comparison between our findings and the findings of similar studies does not conclusively solve the issue of whether the increases in participants' entrepreneurial action and new venture creation in our study were due to training or a natural development over time. Yet, the comparison supports rather than contradicts our interpretation that the changes were indeed due to training. Nevertheless, future research could replicate our findings using a randomized control group design to provide additional evidence for our interpretation.

Fourth, there was a considerable drop-out rate at the long-term measurement (T2). Reasons for the drop-out rate were participants' move to other regions of the country where we could not reach them, their contact details were no longer valid, lack of time, or declining to participate because of other reasons. We note that the likelihood to drop out of the long-term measurement (T2) was significantly higher among male participants than female participants. We controlled for a potential selection bias by applying Heckman's (1979) two-stage procedure. Nevertheless, the positive effect of error mastery orientation on the maintenance of entrepreneurial action and new venture creation might have been driven by female participants who might benefit relatively more from error mastery orientation than male participants. We cannot rule this alternative explanation. However, even if the alternative explanation is true, our study makes an important contribution to the literature that seeks to identify ways to close the gender gap in entrepreneurship (Klapper & Parker, 2011).

Fifth, our study was a longitudinal field study and we could not control for alternative explanations that might potentially bias our findings and undermine the internal validity of the study. Future research could provide causal evidence for the effect of error mastery orientation on the maintenance of entrepreneurial action and new venture creation by implementing an experimental design with different conditions of error mastery orientation.

Finally, we note that we conducted exploratory analyses to examine the moderation effect of error mastery orientation on

the relationship between time squared and new venture creation. Using the Bonferroni approach to correct for multiple testing would yield an adjusted p-value that is significant at the 10%-level ($p = .074$). Importantly, this does not undermine the validity of our theoretical model. According to logic of dynamic mediation (Pitariu & Ployhart, 2010), the indirect effect of error mastery orientation on the maintenance of new venture creation through the maintenance of entrepreneurial action over time remains significant because the paths of the indirect effect are not affected by the correction.

Conclusion

Our study showed that error mastery orientation is an important boundary condition of the long-term transfer of action-oriented entrepreneurship training. The context of entrepreneurship is a transfer setting that is characterized by constantly changing circumstances, for example, in terms of customers' preferences, new entrants, and economic conditions. In such an adaptive transfer setting, error mastery orientation boosts and maintains entrepreneurial action after training, ultimately facilitating the maintenance of new venture creation over time.

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Data availability statement

Available upon request.

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