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Published in:
Applied Psychology

DOI:
[10.1111/apps.12054](https://doi.org/10.1111/apps.12054)

IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

Document Version
Publisher's PDF, also known as Version of record

Publication date:
2016

[Link to publication in University of Groningen/UMCG research database](#)

Citation for published version (APA):

Keith, N., Unger, J. M., Rauch, A., & Frese, M. (2016). Informal Learning and Entrepreneurial Success: A Longitudinal Study of Deliberate Practice Among Small Business Owners. *Applied Psychology*, 65(3), 515–540. <https://doi.org/10.1111/apps.12054>

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Informal Learning and Entrepreneurial Success: A Longitudinal Study of Deliberate Practice among Small Business Owners

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Informal learning activities are increasingly acknowledged as significant for learning and development in modern workplaces. Yet, systematic research on effects of informal learning on work-related outcomes remains scarce. The present research focuses on deliberate practice—a construct from cognitive-psychological expertise research that describes effortful practice activities specifically designed to improve one's performance. We propose that deliberate practice can be applied informally at work and, in the context of entrepreneurship, may contribute to entrepreneurial success. In a longitudinal study with 132 small business owners in Germany, we found partial support for the notion that success is increased in entrepreneurs who engage in self-regulated

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Nina Keith and Jens Unger contributed equally to this work and are listed in alphabetical order. This manuscript is based on a larger research project “Psychological Factors of Entrepreneurial Success in China and Germany” (FR 638/23-1) which was supported by a grant from the German Research Foundation (Deutsche Forschungsgemeinschaft). This is the only manuscript on deliberate practice from this research project. As fully disclosed when submitting the manuscript, other parts of the project data were also analyzed and resulted in other publications unrelated to the current one. A list of these publications can be obtained from the authors. Parts of this manuscript were presented at the 2011 Annual Meeting of the Academy of Management in San Antonio, Texas.

and informal deliberate practice. In addition, deliberate practice interacted with environmental dynamism, indicating that deliberate practice pays off particularly in dynamic environments and may be detrimental in stable environments. This research not only informs entrepreneurial research as it sheds light on how entrepreneurs learn and develop their capabilities outside systematic training. It may also have broader implications for work and organisational psychology as self-regulated deliberate practice may be a useful informal learning activity for a wider range of occupations and across work tasks, particularly those with rapidly changing work requirements.

INTRODUCTION

Every year, organisations invest enormous amounts in formal training and development programs for their employees. In 2012, for example, US companies spent approximately \$164.2 billion on training and development (Miller, 2013). Investments in European companies are also high, with some variation between the countries (Boateng, 2009). Likewise, traditional research on organisational learning focuses on formalised training, with training design, training evaluation, and transfer of training as typical research topics (Aguinis & Kraiger, 2009). The importance of formal training notwithstanding, informal learning activities seem to be increasingly acknowledged as another significant source of employee learning. Informal learning typically does not have clearly defined start and end points as well as predefined goals and schedules. It is “unstructured, experiential, and noninstitutional” (Tannenbaum, Beard, McNall, & Salas, 2010, p. 305) and is “most often initiated by the employee themselves” (Sonnentag Niessen, & Ohly, 2004, p. 253). Informal learning can involve a variety of organisational experiences, for example, learning from interactions with peers, superiors, or clients, or reflecting on one’s work techniques (Marsick & Watkins, 1990; Noe, Tews, & Marand, 2013; Sonnentag & Klein, 2000; Tannenbaum et al., 2010).

Some sources estimate that up to 70–80 per cent of all work-related knowledge and skills are acquired informally on the job (Noe, Clarke, & Klein, 2014; Tannenbaum et al., 2010). Informal learning certainly is essential in developing work-related skills as it has the “potential for more meaningful learning experiences than formal training” (Noe et al., 2014, p. 248) and may be suitable for addressing the often discussed need for continuous and life-long learning in modern workplaces. In some professions, informal learning may be even more essential than in others, and entrepreneurship may be such a profession. Entrepreneurs typically do not have the financial resources or the time to engage in much formalised training. Moreover, formal education including training only shows weak relations with entrepreneurial success (Unger, Rauch, Frese, & Rosenbusch, 2011). In order to match entrepreneurs’ requirements, much of their learning and development needs to take place in a self-

regulated manner and as part of their everyday work activities—in the form of informal learning. Also, informal learning is a potentially resource demanding volitional activity (Noe et al., 2014). Entrepreneurs may be more inclined than others to mobilise energy for such activities, given meta-analytic results on entrepreneurs' achievement motivation (Frese & Gielnik, 2014).

The present research investigates effects of informal learning on entrepreneurial success. We believe that the study of informal learning in the context of entrepreneurship is informative both for psychology of entrepreneurship and for work and organisational psychology in general. It is informative for psychology of entrepreneurship because it sheds light on learning processes that entrepreneurs regularly engage in and that may contribute to entrepreneurial success. In this respect, this research is in response to scholars' calls to increase our understanding of how business owners learn and expand their capabilities and knowledge (e.g. Ravasi & Turati, 2005). It is informative for work and organisational psychology in general because informal learning, despite its often cited importance, remains an underresearched research topic (see Noe et al., 2013, 2014; Tannenbaum et al., 2010); the study of this topic in entrepreneurs may have broader implications for informal learning processes and outcomes in the context of work, at least for jobs with similar levels of job challenge, control, and demands.

More specifically, our research focuses on *deliberate practice* as one particular type of learning activity that can be applied informally at work (Sonnentag & Kleine, 2000; Sonnentag et al., 2004). Deliberate practice is a concept from cognitive-psychological expertise research that has recently attracted some attention in (among other fields) entrepreneurship theory and research (Baron & Henry, 2011). Although originally applied to exceptional performance in fields such as chess, music, and sports, deliberate practice may also—with some modifications and qualifications—be applied to the domain of work in general as well as to entrepreneurship. In line with this proposition, deliberate practice has been suggested as contributing to entrepreneurial performance (Baron & Henry, 2010; Read & Sarasvathy, 2005; Unger, Keith, Hilling, Gielnik, & Frese, 2009) as well as to job performance in general (Macnamara, Hambrick, & Oswald, 2014; Sonnentag & Kleine, 2000). However, empirical research that explicitly tests for effects of deliberate practice in the field of entrepreneurship remains scarce and is restricted to cross-sectional studies, despite calls for more longitudinal research in the field of entrepreneurship (Baron & Henry, 2011). This research seeks to fill this gap by replicating the effect of deliberate practice on entrepreneurial success found in a South African sample of small business owners (Unger et al., 2009) using a longitudinal design in a different setting (i.e. German small business owners).

Finally, and more importantly from a substantive point of view, the present study does not solely focus on potential main effects of deliberate practice but also considers a context factor that may moderate the effect of deliberate

practice, namely, environmental dynamism. We propose and test the notion that deliberate practice is particularly effective if entrepreneurs act in a dynamic business environment, whereas for entrepreneurs in a relatively stable environment deliberate practice activities may be less effective. Adopting this contingency perspective is in line with the proposition that individual-level factors often interact with other behavioral or environmental factors (Baron & Henry, 2011; Hmieleski & Baron, 2009). In all, we believe that our research has the potential to contribute both to entrepreneurship as a field of study and to bridge psychology with entrepreneurship as it demonstrates how basic cognitive-psychological concepts (i.e. deliberate practice) can be used to explain applied phenomena (i.e. entrepreneurial success). In the following, we define the concept of deliberate practice and detail how it can be adopted in workplace learning and entrepreneurship. We also describe environmental dynamism as a context factor of firms and its moderating role for effects on firm success.

Deliberate Practice and Performance

Deliberate practice—originally introduced to explain exceptional performance in fields such as chess, music, and sports—describes practice activities that are “specifically designed to improve the current level of performance” (Ericsson, Krampe, & Tesch-Römer, 1993, p. 368) and that are typically designed by a trainer or instructor who also provides corrective feedback. For example, a violinist who repeats playing scales as finger exercise or a chess player studying games of world class chess masters would be engaging in deliberate practice. An important tenet of the deliberate practice framework is that mere performance of an activity (e.g. playing the violin or playing chess for fun) does not constitute deliberate practice. For practice to constitute *deliberate* practice, the activities need to explicitly address current weaknesses with the goal of improving this skill area and they need to be engaged in in an effortful and focused way. In other words, it is a volitional activity that is resource demanding and that cannot be pursued over very long time periods. This also implies that deliberate practice differs from mere experience in a particular domain, for example, in terms of mere accumulated hours of doing an activity (e.g. hours of playing chess or the violin in the course of one’s life; Ericsson et al., 1993).

Another assumption within the deliberate practice framework is that deliberate practice—but not mere performance of an activity—is suitable for continuous improvement in a skill area beyond the state of “arrested development” (Ericsson, 2006, p. 696) that is usually reached after some practice. Contemporary theories of skill acquisition (e.g. Anderson, 1982; Hacker, 2003; Frese & Zapf, 1994) posit that while in the beginning of skill acquisition (e.g. of motor movements) practice is effortful, intentional, and requires conscious control, actions (e.g. movements) become automatized and can be

processed without explicit conscious control (Johnson, Chang, & Lord, 2006). At this point of routinisation and arrested development, merely repeating the same activity does not lead to increased levels of performance. Rather, only deliberate practice activities specifically designed to address performance deficiencies and aimed at altering the use of suboptimal techniques are suitable to overcome these “detrimental effects of automaticity” (Ericsson, 2006, p. 696). For example, a hobby tennis player can learn the basic tennis strokes (e.g. forehand, backhand, serve) up to some satisfactory level after a certain amount of practice but will not further improve significantly unless she systematically trains to change suboptimal techniques that she may have adopted during practice. In other words, deliberate practice implies that practice goes beyond the skill level already mastered. It implies stretching one’s performance (Ericsson, 2006) and is different from mere repetition of routinised techniques and strategies which may be associated with satisfactory but not optimal performance in a skill domain.

The major proposition of deliberate practice theory is that deliberate practice is essential and necessary to obtain exceptional levels of performance in a given domain. In line with this assumption, research has found deliberate practice to be associated with performance across a number of domains such as music (Ericsson et al., 1993; Sloboda, 1996), sports (e.g. Hodges, Kerr, Starkes, Weir, & Nananidou, 2004), and chess (Charness, Tuffiash, Krampe, Reingold, & Vasyukova, 2005). A recent meta-analysis that included 157 effect sizes yielded a positive and significant average effect size of .43 (effect size r with correction for unreliability; Macnamara et al., 2014), although the effect sizes varied significantly across domains and methods of assessment of deliberate practice and performance.

When applying the concept of deliberate practice to work-related skills, certain differences between work tasks and tasks of classical domains of expertise research need to be taken into account (see Baron & Henry, 2010; Keith & Ericsson, 2007; Sonnentag & Kleine, 2000; Unger et al., 2009). First, work tasks may not be as well defined and as static as tasks in many classical domains. The tasks of entrepreneurs in particular are often ill-defined, uncertain, and complex (Frese & Gielnik, 2014). Second, deliberate practice activities in classical domains are often structured by instructors or teachers (i.e. formal learning). At work, particularly for small business owners, there is usually no such teacher or trainer present. Therefore, one needs to engage in deliberate practice in a self-regulated and informal manner, that is, by adopting the goal of performance improvement, identifying areas of possible improvement, and designing as well as executing deliberate practice tasks that are suitable for performance improvement (e.g. mental simulations of difficult situations with clients; see Sonnentag & Kleine, 2000). The same applies for feedback: While in classical domains of expertise research, a trainer or instructor may provide feedback, in the entrepreneurial context feedback needs to be actively sought

and, furthermore, processed adequately. Individuals probably differ in the extent to which they spontaneously engage in such self-regulated deliberate practice and in processing of feedback.

Note that this difference (i.e. presence vs. absence of trainer/instructor) between deliberate practice in classical domains of expertise and in typical work situations also touches upon the distinction between formal and informal learning which we have referred to above. In classical domains, deliberate practice often includes formal learning situations (e.g. lessons). At work, particularly in the context of entrepreneurship, however, we argue that deliberate practice largely occurs informally and in a self-directed manner outside formalised settings (Sonnentag & Kleine, 2000; Sonnentag et al., 2004), as entrepreneurs usually do not have the time to participate in formal classroom-based training. In the present research, therefore, we focus on informal deliberate practice activities.

Third, the concept of deliberate practice was originally developed to explain exceptional performance rather than performance of an average range. To apply the concept to everyday and average work-related performance, we need to assume that no qualitative difference exists between excellent and intermediate performance but that intermediate and excellent performances merely represent different values on the same performance dimension (see Keith & Ericsson, 2007). Finally, while acknowledging that deliberate practice is different from mere task execution (Ericsson et al., 1993; Ericsson, 2006), we need to assume that deliberate practice activities can be pursued as part of one's job (Day, 2010). That is, while some activities at work may be pursued to merely get one's job done (i.e. mere task execution), others may be pursued with the explicit goal of performance improvement in the long run; only the latter qualify as deliberate practice (see Sonnentag & Kleine, 2000).

Empirically, the effect of deliberate practice on performance in the domain of work has not been tested very often. In the meta-analysis by Macnamara et al. (2014) only seven of the 157 effect sizes included belonged to professions. They yielded an average effect size of zero ($r = .05$). Of these seven effect sizes, however, three were drawn from one sample of soccer referees (a profession not typically the subject of research in work and organisational psychology). Also, the seven effect sizes varied considerably (range of $-.37$ to $.37$). The average zero effect size, therefore, should be interpreted with caution and probably does not necessarily generalise to other professions. In an interview study with insurance agents (which was included in the meta-analysis), Sonnentag and Kleine (2000) found the amount of deliberate practice (e.g. mental simulations, exploring new strategies)—but not mere work experience—to be significantly related to supervisor-rated performance. In their study, Unger et al. (2009; not included in the meta-analysis) conducted interviews in a sample of South African small business owners and identified deliberate practice activities similar to those included by Sonnentag and Kleine (2000), namely, private

conversation, firm meetings, exploring new strategies, mental simulation, asking customers for feedback, consulting colleagues or experts, attending workshops/training, professional reading, observing others, and controlling/checking; in this study deliberate practice predicted entrepreneurial knowledge which in turn predicted entrepreneurial success (mediation effect). In the following, we explicate in more detail why deliberate practice may positively affect entrepreneurial success.

Deliberate Practice and Entrepreneurial Success

There is wide agreement among scholars that the ability to learn is critical to achieve business success (see Audia, Locke, & Smith, 2000; Burgelman, 1990; Cope, 2005; Gibb, 1997; Grant, 1996; Levinthal & March, 1993; Zahra & George, 2002). Entrepreneurship “is a process that is characterised by significant and critical learning events. The ability of entrepreneurs to maximise knowledge as a result of experiencing these learning events will determine how successful their firm eventually becomes” (Deakins & Freel, 1998, p. 153). Along with others, we argue that deliberate practice is a useful concept to study such processes of learning in entrepreneurship (Baron & Henry, 2010, 2011; Read & Sarasvathy, 2005). First, owners need to learn because they are affected by technological developments, increased customer demands (Thayer, 1997), and growing competition. In response to such developments, business owners need to continuously engage in processes of learning to adjust their skills and knowledge. In entrepreneurial contexts, activities with an explicit goal of competence improvement may facilitate the acquisition of new domain-specific knowledge. For example, regularly asking customers for feedback or consulting colleagues with the explicit goal of competence improvement may help owners to learn about new trends and changing demands in their market and, thereby, increase their market knowledge. Increased market knowledge, in turn, may enable owners to respond more quickly and adequately to change and to be ultimately more successful.

Second, self-regulated learning is especially suitable for small business owners. While programs of competence development are typically provided to employees of larger firms, business owners have to identify and address learning needs by themselves. Owners therefore need to assume a proactive stance towards learning—an important task that owners may manage by engaging in deliberate practice, including conscious self-monitoring and active processing of feedback that, over time, help owners realise when there is a problem and correct mistakes accordingly. Third, business owners may themselves become agents of change and development (Schumpeter, 1934) rather than merely responding and adapting their competencies to changes in the environment (e.g. by introducing new products). Therefore, they need to explore, discover, and pursue new business opportunities (Shane & Venkataraman, 2000). A

deep level of processing information, as implied by deliberate practice, may facilitate the identification of viable business opportunities through enhanced recognition of patterns between seemingly disparate and unrelated events (e.g. changes in technology, shifts in demographics, alterations in government policies, etc.; Baron & Henry, 2010, 2011). Taken together, the above stated arguments suggest that deliberate practice is relevant to learning and skill development in entrepreneurship. The concept of deliberate practice may help to better understand how business owners engage in self-directed learning to adapt to environmental changes, to anticipate new developments and produce change themselves, and to proactively acquire relevant skills and knowledge—actions that may in turn lead to increased entrepreneurial success.

Hypothesis 1: Deliberate practice has a positive effect on success.

Moderating Effects of Environmental Dynamism

Learning is imperative in the face of ongoing and rapid changes in modern work environments including entrepreneurship. By extension, learning in entrepreneurship may be more central the more rapidly changes occur in the business environment. Dynamic environments are characterised by such rapid and unpredictable changes (Hmieleski & Baron, 2009). Adopting a contingency perspective of organisational behavior of owners (Katz & Kahn, 1978), we argue that the more dynamic the environment of a business owner, the stronger the learning need, and the stronger the requirement to adapt to and to prepare for environmental change (e.g. market changes, technological development, increased and changing customer demands) through engagement in deliberate practice. Furthermore, as described above, deliberate practice is a volitional and mentally effortful activity that may consume motivational and cognitive resources as well as, more practically, time and possibly financial resources. In a situation in which changes and adaptations are unnecessary and in which following one's routines as well as established strategies and techniques may suffice (i.e. in a stable business environment), deliberate practice may be ineffective or even detrimental, as resources are wasted that should rather be spent otherwise (see Kanfer & Ackerman, 1989). This is not to imply that engaging in deliberate practice in a dynamic environment was an easy task. On the contrary, in turbulent times, in which entrepreneurs are busy with mere task accomplishment, it may be particularly difficult to spend additional volitional energy and effort in deliberate practice activities. Still we maintain that if entrepreneurs do so, they can benefit as their practice activities will lead to learning that will ultimately help them master the new challenges they are facing; sticking to one's routines and focusing on mere task accomplishment, in contrast, may appear to be immediately useful as it is less resource-

consuming but may not pay off in the long run. For these reasons, we suggest effects of deliberate practice on success to be contingent on the level of environmental dynamism; we expect the effects to be most pronounced in dynamic environments (a similar argument has been made for dynamic capabilities on the level of firms; see Zahra, Sapienza, & Davidsson, 2006).

Hypothesis 2: Environmental dynamism moderates the relationship between deliberate practice and success. Effects of deliberate practice on success are positive and stronger for owners in highly dynamic environments compared to owners in less dynamic environments.

Note that this prediction appears to be at odds with the results of the recent meta-analysis on deliberate practice by Macnamara et al. (2014) who found predictability of the task environment—which has some similarity with our moderator environmental dynamism—as a moderator (although they did not offer a theoretical explanation); effect sizes were larger in predictable environments (e.g. the sport of running) than for activities low in predictability (e.g. handling an aviation emergency). As described above, however, there are structural differences between classical domains of expertise research included in the meta-analysis and the situation of entrepreneurs and other professions in which “deliberate practice is less well defined” (Macnamara et al., 2014, p. 8) than in classical domains. Another difference is the necessity and potential benefit of deliberate practice. While in classical domains, any expert and aspiring expert typically spends infinitely more time on practice activities than on performing, the pattern is reversed in professional domains in which most of the time is needed for performing one’s job; whether there is the necessity to engage in deliberate practice and whether it pays off to do so is contingent on the necessity to learn (i.e. in dynamic environments).

METHOD

Sample

The study includes a longitudinal sample of business owners, sampled from a large and economically highly successful area in Germany. At Time 1 (T1) we randomly selected and contacted owners via public registries. We used a multiple-industry design (see Covin, Green, & Slevin, 2006; Kreiser, Marino, Dickson, & Weaver, 2010; Wiklund & Shepherd, 2003) whose advantage is that findings can be better generalised to multiple industries and are not confined to the one particular line of industry in which the research has been conducted. The disadvantage is the heterogeneity of firms and industries that may systematically relate to dependent variables. To account for this, we restricted our research to four industries: information technology (25%), gastronomy (23%),

automobile (13%), and construction (38%), and statistically controlled for line of industry in all analyses. Despite certain differences, we expected informal learning to be possible and potentially beneficial in all four industries.

Of the 290 business owners who participated at T1 (response rate: 43%), 187 owners (64%) responded again two years later at Time 2 (T2). To be included in the study, participants had to be owners and active managers of their firm, have at least one employee, and have been in business for at least one year. Participation involved an interview and a questionnaire at both T1 and T2. The total number of participants who responded to both the interview and the questionnaire at both T1 and T2 was 132. The average firm size was small as most firms are small (average no. of employees = 10.15, $SD = 13.17$). Average age of owners was 44.56 ($SD = 8.92$) and the vast majority were male (83.3%). About half of participants (50.3%) held a university degree. Average years of education (i.e. general schooling and professional training or university studies) was 16.09 ($SD = 3.53$). Average age of firm was 20.83 years, with some variation ($SD = 30.13$) as there were relatively young firms as well as some traditional firms more than 100 years old in the sample.

Procedure

We conducted lengthy structured interviews with the owners at both T1 and T2 and, subsequently, asked them to fill out a questionnaire and to send it back to us (postage was included). Interviews were performed by graduate students of psychology who were trained in a 2–3-day training in interview techniques, coding, and note taking. This training included role-playing the interview situation. An experienced interviewer accompanied the new interviewers during their first actual interviews. To ensure high quality of the interviews, feedback interviews were conducted on a regular basis. In addition, consultative meetings were held regularly to minimise coding biases. Directly after the interviews, interviewers filled out a questionnaire (the interviewer evaluation form) that captured the interviewer's impression. Interviewers were explicitly trained in the use of the interviewer evaluation form.

In longitudinal studies, assumptions about the timing of effects need to be made. In the present study, the time lag of two years between T1 and T2 was chosen for the following reasons. A time lag of less than one year is not advisable in an entrepreneurial sample, as seasonal effects (e.g. in the construction industry) may obscure any real changes in dependent variables. Also, firm success is a criterion that is much more delayed than other performance criteria (Smith, 1976). We therefore chose a longer time interval of two years between T1 and T2 as is commonly done in small business research (e.g. Delmar & Wiklund, 2008; Rauch, Frese, & Utsch, 2005).

Measures

Deliberate Practice. Deliberate practice was measured in the questionnaire at T1. We used a measure by Sonnentag and Irion (2010) consisting of 15 items that described diverse deliberate practice activities and that had been developed based on activities identified in a structured interview (Sonnentag & Kleine, 2000; see also Unger et al., 2009). The activities comprised discussing or asking (e.g. employees or colleagues) or researching the internet or other written material on work techniques, on new developments in the field, or on other work-specific information as well as reflecting on one's work techniques and deliberately trying out new ones. All of the items referred to informal learning activities. Although developed independently, the items appear to resemble the measure of informal learning developed by Noe et al. (2013) (who refer to the work by Sonnentag & Kleine, 2000). Their measure involves learning from oneself (e.g. reflecting, experimenting), from others (e.g. discussing with or asking others), and from non-interpersonal sources (e.g. searching the internet). In the present study, before filling out the items, participants were asked to answer two questions. These questions were designed to focus participants' attention on activities and skills required for their work that they could deliberately improve. First, participants were asked to write down three activities that are typical of their work. Then, owners indicated what skills and knowledge they needed to perform these activities. Subsequently, the 15 items by Sonnentag and Irion (2010) were presented. Each item began with the stem "In order to improve my skills, . . .", and continued with a particular deliberate practice activity. Items were to be answered on a 6-point scale ranging from seldom/never (1) to every day (6). Sample items are, "In order to improve my skills, I deliberately take some time to re-think my working techniques" and "In order to improve my skills, I deliberately try out new techniques". Items were aggregated to form a scale of deliberate practice (Cronbach's alpha = .91).

Environmental Dynamism. We used five items to measure environmental dynamism at T1 (Miller & Friesen, 1982). Participants were asked to indicate which business environment best described their own situation. The answer format was a 7-point scale with the end points representing a very dynamic (e.g. "The way of production/service changes frequently and substantially") and a very stable environment (e.g. "The technology for our products/services is well established and rarely changes"). Items were aggregated to form a scale of environmental dynamism (Cronbach's alpha = .68). Environmental dynamism was also assessed at T2 (Cronbach's alpha = .70) but was not used in analyses as we were interested in lagged effects. To account for differences between lines of industry (which were not the focus of our study), we used scores that were standardised within lines of industry.

Measures of Success. Unfortunately, German small business owners are not willing and often also not able to provide detailed auditing type measures (e.g. cashflow, profit, exact sales volume) due to their fear that data might get into the wrong hands. Therefore, we needed to get robust measures that the entrepreneurs were willing to provide. We used subjective success, the interviewer evaluation of success, and the number of employees. Because we controlled for prior success in all analyses, we are actually testing effects on *change* in these success variables from T1 to T2 (see Warr, Allan, & Birdi, 1999) and we also control for constant sources of common method variance.

Subjective Success. We used a seven-item self-report measure of organizational success. Four of the items were adapted from Van Dyck, Frese, Baer, and Sonnentag (2005) and dealt with business success in general (e.g. "How successful is your business in comparison to other businesses in the same industry and of about the same size?"). The other three items were adapted from Wiklund and Shepherd (2003) and asked owners to rate their own firm's performance relative to their most important competitors with regard to growth in sales, personal income, and number of employees, for example, "During the last two years, how did your business develop regarding sales growth in comparison to your two most important competitors?" All items were rated on 5-point scales. Items were aggregated to form a scale of subjective success. The scales used have been shown to be related to objective success in prior studies (e.g. van Dyck et al., 2005). We used the same measure at Time 1 (Cronbach's alpha = .76) and Time 2 (Cronbach's alpha = .79). A paired *t*-test indicated that owners subjectively evaluated their success more positively at T2 than at T1, $t(130) = -2.14, p < .05, d = 0.19$.

Interviewer Evaluation of Success. The interviewer evaluation of success was based on interviewers' assessment that was recorded right after the interviews when impressions were still vivid. We used two items, both of which were answered on a 5-point scale. The first item involved the interviewers' general assessment of success. This measure allowed interviewers to capture all observations of the firm during and outside the interview. The second item assessed the standard of equipment of the firms. The two items correlated substantially (r at Time 1 = .41, $p < .01$; r at Time 2 = .43, $p < .01$) and were aggregated to indices of success. A similar measure has been used in previous research, where it has been shown to be a good summary measure of success. In these studies, the interviewer evaluation of success correlated substantially with other measures of firm success such as number of employees (from .42 to .53) and an expert evaluation of success ($r = .78$; all $p < .05$; Frese et al., 2007). A paired *t*-test indicated that interviewers' evaluations of success were more positive at T1 than at T2, $t(131) = 2.17, p < .05, d = -0.19$.

Number of Employees. Number of full-time employees was used as another measure of firm success (same measure at Time 1 and Time 2). Since our analyses control for number of employees at Time 1, this variable measures growth in employment. Employment growth has been used frequently in entrepreneurship research (e.g. Delmar & Wiklund, 2008; Rauch & Rijdsdijk, 2013). A paired *t*-test indicated that number of employees had increased from T1 to T2, $t(128) = -3.17, p < .01, d = 0.28$.

Control Variables. We used three variables to code the four lines of industry included in our sample (unweighted effects coding; Aiken & West, 1991). We also used age of owner, years of education of owner, and age of firm as control variables because they correlated with at least one predictor or one dependent variable (Table 1). As an additional reason, years of education was included as an indicator of formal learning of owners (see Unger et al., 2009)—a variable that may be confounded with informal learning and which we included to control for spurious effects of informal learning.

RESULTS

As depicted in Table 1, the success variables correlated significantly within measurement occasions, supporting the validity of measures, with correlations ranging from .18 to .50 (all $p < .05$). The only non-significant correlation was between number of employees at Time 1 and subjective success at Time 2 ($r = .16$). The coding variables for lines of industry shared significant correlations with some of the dependent variables (and in one case with a predictor), underscoring the need to include them as controls in further statistical analyses. The other control variables also shared at least one significant correlation with one of the dependent variables or predictors. For example, age of firm was significantly related to number of employees (older firms had more employees). Deliberate practice was unrelated to years of education but was significantly related with environmental dynamism (.35, $p < .01$). This is in line with the proposition that dynamic capability is related to dynamism in the environment (Zahra et al., 2006) and with the assumption that informal learning is more likely in non-routine situations (Marsick & Watkins, 1990). Despite this moderate correlation between the two predictors, no indication of multicollinearity was found in subsequent regression analyses (range of variance inflation factors: 1.12–1.98; range of tolerance values: .51–.89; Cohen, Cohen, West, & Aiken, 2003).

Hypothesis 1 predicted a main effect of deliberate practice on firm success. Hypothesis 2 predicted an interaction of deliberate practice and environmental dynamism, with the effect of deliberate practice on firm success being most

TABLE 1
Descriptive Statistics and Correlations among Study Variables^a

Variable	M	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14
<i>Controls^b</i>																
1. Age of owner	44.56	8.92														
2. Years of education	16.09	3.53	-.10													
3. Gender	—	—	-.10	.06												
4. Age of firm	20.83	30.13	.22**	-.02	-.16											
5. Industry 1	0.04	0.70	-.20*	.20*	.34**	-.20*										
6. Industry 2	-0.10	0.59	-.07	.12	.37**	-.03	.56**									
7. Industry 3	0.15	0.77	.02	.34**	.25**	.02	.41**	.54**								
<i>Predictors (T1)</i>																
8. Deliberate practice	2.90	0.94	-.20*	.05	.01	.01	.17	.11	-.03	(.86)						
9. Environmental dynamism	3.81	1.04	-.08	-.12	.06	.07	.32**	.11	-.06	.35**	(.68)					
<i>Dependent variables</i>																
10. Subjective success (T1)	3.32	0.47	-.17	-.15	.04	-.12	.05	.06	-.11	.12	-.05	(.76)				
11. Subjective success (T2)	3.40	0.51	-.27**	-.20*	.12	-.04	-.01	.06	-.19*	.14	-.08	.60**	(.79)			
12. Interviewer evaluation (T1)	3.56	0.82	-.22**	.15	.10	-.08	.31**	.14	.09	.06	-.01	.50**	.34**			
13. Interviewer evaluation (T2)	3.41	0.83	-.27**	.12	.12	-.02	.34**	.22*	.08	.21*	.05	.36**	.47**	.48**		
14. Number of employees (T1)	8.26	10.94	.01	.06	.01	.29**	-.03	.14	-.10	.06	.09	.18*	.16	.30**	.31**	
15. Number of employees (T2)	8.96	11.53	-.04	.06	.06	.27**	.06	.24**	-.06	.04	.04	.25**	.23**	.39**	.37**	.95**

Note: ^aWhere appropriate, Cronbach's alpha internal consistency reliability estimates are shown on the diagonal in parentheses. 1.29 < N < 132. ^b Unweighted effects coding of four lines of industry using three effect code variables (see Aiken & West, 1991). Gender was coded 0 for female and 1 for male. *p < .05; ** p < .01.

pronounced when environmental dynamism is high. Note that because we controlled for dependent variables at T1, we are actually predicting change in dependent variables (see Warr et al., 1999). We tested these hypotheses in a series of hierarchical moderated regression analyses (see Aiken & West, 1991; Cohen et al., 2003) for subjective success, for interviewer evaluation of success, and for the number of employees. In the first step (Model 1), we included the control variables. In the second step (Model 2), we also included the dependent variable measure at Time 1. In the third step (Model 3), we included and evaluated the main effects of deliberate practice and environmental dynamism. Finally, in the fourth step (Model 4), we included the interaction term of deliberate practice and environmental dynamism. The results are displayed in Table 2.

For subjective success, Hypothesis 1 was not supported, as deliberate practice did not predict change in subjective success in Model 3. Hypothesis 2 was supported, as the interaction (Model 4) was significant. The shape of the interaction was in line with predictions: The effect of deliberate practice was most pronounced when environmental dynamism was high (Figure 1A). Simple-slopes analyses (see Aiken & West, 1991) revealed that only under conditions of high environmental dynamism was the effect of deliberate practice significant ($\beta = .19, p < .05$), whereas for average ($\beta = .02, p = .82$) and for low levels of environmental dynamism ($\beta = -.16, p = .17$), the effect did not differ from zero.

For interviewer evaluation of success, Hypothesis 1 was supported (significant effect of deliberate practice in Model 3). Hypothesis 2 was also supported, as the interaction (Model 4) was significant. The shape of the interaction was in line with predictions (Figure 1B) and simple-slopes analyses revealed that only under conditions of high environmental dynamism was the effect of deliberate practice significant ($\beta = .23, p < .05$), whereas for average ($\beta = .10, p = .22$) and for low levels of environmental dynamism ($\beta = -.02, p = .85$), the effect did not differ from zero.

For employee growth as an indicator of firm success, Hypothesis 1 was not supported, as deliberate practice did not predict employee growth in Model 3. In this model, environmental dynamism had a small but significant negative effect on employee growth. Hypothesis 2 was supported, as the interaction (Model 4) was significant. The shape of the interaction, however, slightly differed from the others (Figure 1C). For low levels of environmental dynamism there was a small but significant negative effect of deliberate practice ($\beta = -.10, p < .05$), whereas there was no effect for average ($\beta = -.04, p = .22$) or for high ($\beta = .02, p = .56$) levels of environmental dynamism.

In sum, we found partial support for the main effect of deliberate practice on change in firm success (Hypothesis 1); for one of three dependent variables the effect was significant. For the interaction of deliberate practice and environmental dynamism (Hypothesis 2), the support was clearer; for all three

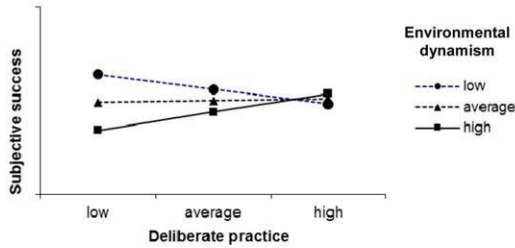
TABLE 2
Results of Hierarchical Regression Analyses for the Effect of Deliberate Practice on Change in Firm Success and for the Moderation of this Effect by Environmental Dynamism^{a,b}

Independent variable	Change in subjective success			Change in interviewer evaluation				Employee growth				
	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
<i>Controls^c</i>												
Age of owner	-.28**	-.20**	-.19**	-.20**	-.21*	-.16 [†]	-.13	-.14 [†]	-.06	-.05 [†]	-.06 [†]	-.06*
Years of education	-.16 [†]	-.08	-.10	-.09	.07	.03	.01	.02	.13	.00	-.01	-.00
Age of firm	.01	.06	.07	.03	.09	.08	.09	.06	.30**	-.00	.01	-.01
Industry 1	-.06 [†]	-.07	-.07	-.06	.30**	.18 [†]	.17 [†]	.18 [†]	-.01	.03	.03	.04
Industry 2	.21	.14	.13	.11	.08	.09	.08	.05	.41**	.06	.06	.05
Industry 3	-.23**	-.16 [†]	-.14	-.13	-.10	-.08	-.06	-.05	-.32**	-.04	-.04	-.03
Dependent variable at T1	.54**	.54**	.53**	.51**	.38**	.38**	.38**	.36**	.94**	.94**	.94**	.94**
<i>Main effects of predictors (T1)</i>												
Deliberate practice			.07	.02			.14*	.10			-.02	-.04
Environmental dynamism			-.12	-.12 [†]			-.08	-.09			-.06*	-.06*
Interaction			.19**	.19**				.14*				.06*
× Environmental dynamism					.18**	.30**	.32**	.34**	.21**	.91**	.91**	.91**
R ²	.16**	.43**	.44**	.47**	.16**	.30**	.32**	.34**	.21**	.91**	.91**	.91**
ΔR ²	.27**	.27**	.01	.03*	.13**	.13**	.02	.02 [†]	.70**	.70**	.00 [†]	.00*

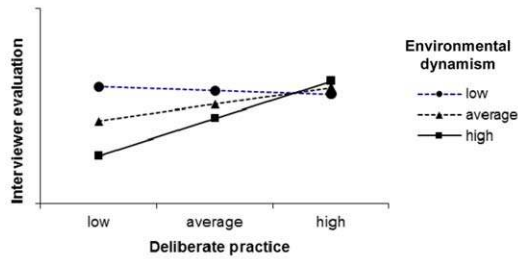
Note: ^a Standardised regression coefficients are reported. Two-tailed tests of significance were used except for hypothesised relationships, for which one-tailed tests were used. ^b Sample sizes were $N = 132$ for interviewer evaluation of success, $N = 131$ for subjective success, and $N = 129$ for number of employees. ^c Unweighted effects coding of four lines of industry using three effect code variables (see Aiken & West, 1991).

[†] $p < .10$; * $p < .05$; ** $p < .01$.

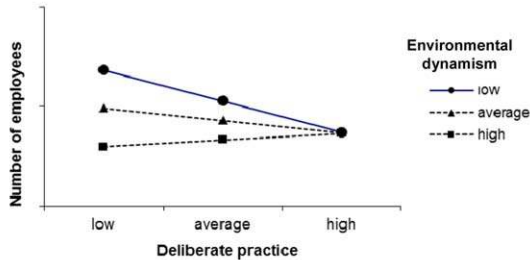
(1A) Change in subjective success



(1B) Change in interviewer evaluation of success



(1C) Change in number of employees (employee growth)



^a Dotted lines represent simple slopes that do not significantly differ from zero.

FIGURE 1. Interactions of deliberate practice and environmental dynamism on change in three measures of firm success.^a

dependent variables the interaction was significant. In addition, the shape of the interaction was as predicted for two of the three dependent variables. For the third dependent variable (i.e. number of employees), the shape of the interaction was somewhat consistent with predictions but slightly different, as there was no positive effect of deliberate practice in dynamic environments but a negative one in stable environments. Note, however, that we found an interaction for this dependent variable despite its extremely high stability from Time 1 to Time 2 (Model 2 $\Delta R^2 = .70, p < .01$).

DISCUSSION

Deliberate practice involves effortful and goal-directed practice activities specifically designed to improve performance in a particular skill. While originally developed to explain exceptional performance in classical domains of expertise research such as chess, music, or sports, the basic assumptions associated with this concept can be—with some modifications and qualifications—fruitfully adopted to a broader range of skills, including professional skills, although only few studies have done so to date (see Macnamara et al., 2014). More specifically, deliberate practice with regard to work-related skills may be conceived of as one type of informal learning that workers in various jobs and professions may engage in. The present study applied the concept of deliberate practice to a sample of German entrepreneurs in a longitudinal study, replicating and extending earlier cross-sectional studies with insurance agents (Sonntag & Kleine, 2000) and entrepreneurs in South Africa (Unger et al., 2009).

Our study yielded partial support for the proposed main effect of deliberate practice (significant main effect for one out of three dependent variables). We further found the expected moderating effect of environmental dynamism, with the effects of deliberate practice being most pronounced for entrepreneurs in dynamic environments (two out of three dependent variables), while there was also some indication (one of three dependent variables) that deliberate practice can be detrimental to success in stable environments. By and large, the study is consistent with the widely accepted assertion among organisational and entrepreneurship scholars that learning and the ability to change are important capabilities of firms (Barney, Wright, & Ketchen, 2001; Busenitz & Alvarez, 2007). To our knowledge, this study is among the first to apply the concept of deliberate practice to work settings and the first to explore the impact of deliberate practice on success in small businesses within a longitudinal setting.

The main effect of deliberate practice for which we found some support is in line with previous findings that applied deliberate practice to the domain of work. The fact that we found a main effect for only one of our three dependent variables and the somewhat small magnitude of this effect indicates that the influence of deliberate practice on firm success as a single explanatory source may not be as large as suggested in earlier cross-sectional research. On the other hand, the moderating effect we found suggests that deliberate practice may be an important predictor but needs to be considered in context (see Baron & Henry, 2011), that is, in interaction with environmental dynamism. This moderating effect of environmental dynamism yielded a clear picture at least for two of the three dependent variables. Apparently, deliberate practice unfolds its effects for entrepreneurs or firms in dynamic environments, whereas in stable environments it is unrelated to entrepreneurial success or may even be detrimental.

This interactional pattern is both in line with predictions drawn from deliberate practice theory and with assumptions of entrepreneurship theory. Deliberate practice theory stresses that practice activities need to be specifically designed to address current weaknesses in performance. Particularly in cases in which a preliminarily acceptable level of performance (“arrested development”; Ericsson, 2006, p. 696) is reached can deliberate practice activities be useful to stretch oneself to reach higher levels of performance by introducing new strategies and techniques. In stable and predictable environments, in contrast, there may be no necessity to break with old routines and to learn new strategies and techniques (i.e. deliberate practice). Trying out new things may even be detrimental to performance as it is unnecessary and may consume resources that should rather be devoted otherwise. Note, however, that the interactional pattern we find is not in line with the moderating effect found in the recent meta-analysis on deliberate practice (Macnamara et al., 2014), in which the effect of deliberate practice was larger for activities high (rather than low) in predictability. As we have described in the theory section, we did not expect to find the same interactional pattern due to structural differences between the situation of experts in classical domains (e.g. chess, music, sports) and of entrepreneurs. Entrepreneurship theory suggests that entrepreneurship is a complex phenomenon that can hardly be understood with reference to simple and single factors but that several processes and context factors act in concert to affect firm success (Baron & Henry, 2010, 2011). The present study adopted a contingency perspective and focused on environmental dynamism as one such context factor. While we believe that our study is a good beginning to understand the interplay between learning/deliberate practice and environmental dynamism, certainly further research is needed to substantiate the interaction found in this study and to explore some of the interpretations offered above.

Practical Implications

Our findings have implications for policy makers, educators, lenders, and the owners themselves. First, business owners may be instructed how to apply deliberate practice. Our findings show the importance of learning for small business owners, particularly in dynamic environments. Deliberate practice appears to offer a practical, flexible, and readily applicable tool to address the learning needs of small business owners. Moreover, deliberate practice (e.g. mental simulation of difficult work situations) can be applied independently of specific learning contents and across industries. Specifically designed training may teach owners how to design deliberate practice activities most suitable for the specific learning needs and situations in their business. Second, business owners should be made aware of the relevance of learning in small businesses and the potential impact of deliberate practice on business outcomes.

According to our results, learning and success at least partially remain the responsibility of the owners themselves who may—or may not—opt to engage in self-regulated deliberate practice to improve their firm's performance. Finally, deliberate practice may also become practically relevant for personnel development in larger firms or for those employees who are keen to improve their skills as it is a proactive kind of learning behavior (Noe et al., 2014) that may be flexibly adapted to tasks and demands. Stated differently, the deliberate practice activities identified in earlier studies and assessed in the present one (e.g. mental simulations of difficult work situations, exploring new work strategies) may be generalisable and helpful for performance improvement across a wide range of tasks and jobs. As such, the concept may offer a promising tool of learning and development for employees and employers in various work environments.

Limitations

One limitation of this study concerns the measurement of success. The difficulty of measuring performance in small businesses has repeatedly been pointed out in entrepreneurship research (Daniels, 1999; Frese et al., 2007; Wiklund, 1998). Many owners are hesitant to disclose sensitive performance data. It is therefore difficult to get hard data from small business owners. We dealt with this problem using multiple operationism (Webb, Campbell, Schwartz & Sechrest, 1966) by including success from different sources. While subjective organisational success and number of employees were obtained from the owner as a self-report measure, the interviewer evaluation of success was based on an independent external rating by the interviewers. This helped reduce the possibility of effects of common method variance in our results. The fact that we found by and large similar results for the three success indicators supports the validity of our findings. Furthermore, it should be noted that the subjective measure of success had low variance (see Table 1)—a common phenomenon for self-reports of performance (e.g. Harris & Schaubroeck, 1988). While the low variance of subjective success may pose a problem because of range restriction, we found effects for this variable despite this range restriction.

A similar criticism applies to our subjective measure of environmental dynamism, which also had non-optimal measurement properties (Cronbach's alpha of .68). While an advantage of measuring environmental dynamism subjectively is that data can be easily obtained across a range of lines of industry, a more objective assessment of environmental dynamism may be desirable. For example, Hmieleski and colleagues have proposed an interesting measure of environmental dynamism that is based on predictability over time and that (if available) can be derived from objective factors such as industry revenues or

number of industry establishments (Hmieleski & Baron, 2009; Hmieleski & Ensley, 2007).

Although we believe that the effects we found for deliberate practice and its interaction with environmental dynamism are actually due to deliberate practice, we cannot be sure whether we have not picked up a spurious relationship—a limitation that applies to any non-experimental, survey-based research, irrespective of it being cross-sectional or longitudinal. For example, it is possible that deliberate practice is confounded with formal training or education (i.e. that entrepreneurs who engage in deliberate practice have also received more formal training) and that the deliberate practice effects are actually driven by formal training. To rule out this alternative explanation, we included a proxy for formal training (i.e. years of education; see Unger et al., 2009) as control variable in our analyses, with stable effects indicating that the relationships of deliberate practice were not spurious. Future studies may include other measures of formal training (e.g. regular participation in workshops or seminars, rather than formal training received in the past) or other alternative variables with which deliberate practice may be confounded.

Future Research

Future studies may explore antecedents of deliberate practice. While previous research has examined cognitive antecedents of deliberate practice among small business owners (Unger et al., 2009), future studies may focus on motivational antecedents. Deliberate practice incorporates a high degree of effort on the part of the owner, like informal learning in general (see Noe et al., 2014). It would therefore be interesting to better understand the motivational prerequisites of deliberate practice. For example, owners with a higher need for achievement, higher learning self-efficacy, or higher learning orientation may engage in more deliberate practice. That being said, we do not claim that any potential effects of these motivational variables are fully mediated by deliberate practice. Rather, there may be direct effects of these variables that are independent of deliberate practice or effects mediated by variables other than deliberate practice such as, for example, other types of informal learning (e.g. incidental learning).

In addition, the effects of deliberate practice could be specifically studied across different stages in the life cycles of small businesses and in the context of venture creation and serial entrepreneurship. For example, engagement in deliberate practice may occur more frequently in the early part of the life cycle of a firm and its effects on learning may be more pronounced in such phases corresponding to the higher learning need and the steeper learning curve during the initial years (Baron, Frese, & Baum, 2007). Also, studying the link between deliberate practice and serial entrepreneurship may be interesting. Occasionally the literature has equated serial entrepreneurs with

entrepreneurial expertise (see Read & Sarasvathy, 2005). Indeed, evidence suggests that entrepreneurial action and performance improves with the number of business ventures (Shane, 2003). Deliberate practice may explain these rising levels of performance among individuals who start several new ventures during their careers while lack of deliberate practice may account for failures of serial entrepreneurs.

Future research may also explore conditions under which applicability of deliberate practice is limited. For example, for some skills (e.g. social skills), it may be difficult to clearly interpret feedback on efficient and non-efficient actions and, as a consequence, to design adequate deliberate practice activities for performance improvement. A similar case has been made for learning from errors in training and at work (Frese & Keith, 2015; Keith & Frese, 2008) and for learning from experience in leadership development (Day, 2010; DeRue & Wellman, 2009). Finally, the present study focused on the effects of deliberate practice on firm success—a dependent variable which is most important from the view of research in entrepreneurship (Baron & Henry, 2011). Within the broader scope of work and organisational psychology and of other professions and jobs, however, other dependent variables may be of interest. For example, future research may explore under what circumstances engaging in deliberate practice leads to positive or negative consequences in terms of subjective well-being and it may, in line with contemporary theorising and research on well-being, identify processes mediating such effects. Other important dependent variables potentially promoted by deliberate practice may be creativity and innovation of firms or of individuals within firms.

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