The Timing of Training Effects: A Learning Curve Perspective

Achim Krausert

Warwick Business School

Author Note

Achim Krausert, Warwick Business School, University of Warwick

Correspondence to: Achim Krausert, Warwick Business School, University of Warwick, Coventry CV4 7AL.

Phone: 024 7652 4273.

Email: achim.krausert@wbs.ac.uk.

To cite the paper:
Abstract

This conceptual study examines differences in the timing of training effects across types of training. It proposes a distinction between learning curve *shift* and learning curve *acceleration* effects of training. A multilevel model is developed outlining differences between these effect types in terms of lag effects as well as the effect duration (attributable to factors such as synergistic effects among different training activities, “training roll out” across the workforce, and collective sense-making and role negotiation processes). The model is applicable both where training is effective by inducing (positive) change and where it is effective by preempting (negative) change. The study contributes to the identification of future-oriented HR investments—with implications for corporate governance.

*Keywords:* Training effects; Time; Learning curve
1. Introduction

This paper contributes to recent literature pursuing the idea that, because the capital market cannot distinguish future-oriented HRM investments from bad management, quarterly earnings targets may create pressures on managers to limit respective HRM investments (Krausert, 2014; Liu, van Jaarsveld, Batt, & Frost, 2014). If only managers could credibly communicate to investors about HRM activities that are linked to future earnings, so the argument, the future effects would be factored into investor expectations and the stock price, improving the ability of managers to support HRM investments without incurring a near-term penalty in their stock-based compensation and job security (Edmans, 2009, 2011).

Consequently, work has been undertaken to develop and establish an HRM signal for the capital market, indicating to investors whether a firm has made HRM investments linked to future earnings (Krausert, forthcoming). What is still missing is a comprehensive understanding of which HRM activities should and which ones should not be considered future-oriented.

The HRM activity that has most commonly been thought to be affected by near-term performance pressures is employee training (e.g., MacDuffie & Kochan, 1995; Porter, 1992). The evidence on the timing of training effects is mixed, however, both with respect to lag effects (e.g. Aguinis & Kraiger, 2009; Ployhart, Van Iddekinge, & MacKenzie, 2011) and with respect to the effect duration (e.g., Blume, Ford, Baldwin, & Huang, 2010; Sung & Choi, 2014). Theory pertaining to the timing of training effects is generally limited (see also Kim & Ployhart 2014; Tharenou, Saks, & Moore 2007). And theory that would explain differences in the timing of effects across different types of training is entirely absent from the literature.

This conceptual study develops a multilevel model to explain differences in the timing of training effects. It proposes a classification of training activities based on whether they
accelerate or shift the learning curves of the targeted employees. Training effects via learning curve shift are proposed to be associated with longer lag effects and a longer effect duration than training effects via learning curve acceleration. The model encompasses a range of mediators explaining different temporal effects, from synergistic effects among multiple training activities through “training roll out” across the workforce to collective sense-making and role negotiation processes. The model is applicable both where training is effective by inducing positive change (i.e., performance improvements) and where it is effective by preempting unintended (negative) change. Thus, the study advances the theoretical understanding with regard to both why and under what circumstances employee training has different temporal effects.

The theoretical basis of the study is learning curve theory, which suggests that performance improves over time (more specifically: with cumulative task experience), at a decreasing rate (Wright, 1936). The proposed shape of the learning curve has been evidenced across a wide range of settings (Lapré & Nembhard, 2010). Given performance continuously improves with task experience—also without training—learning curve theory provides the appropriate theoretical basis for the study of temporal effects of training. Hence, this study will be concerned with training effects on performance (or learning curve) trajectories, as opposed to effects on performance levels.

2. Learning curve effects of employee training

The central proposition of learning curve theory is that performance improves with increasing cumulative task experience, at a decreasing rate (Wright, 1936). The proposed shape of the learning curve has been evidenced across a diverse range of jobs and industries, from airplane manufacturing to pizza making, and across different levels, from the employee through the organizational to the industry level (e.g., Argote, Beckman, & Epple, 1990; Dutton &
Thomas, 1984). The central construct in learning curve research is the learning rate, defined as the performance improvement in percent occurring with every doubling of cumulative task experience. Much of the more recent research has been concerned with differences in learning rates, relating them for instance to differences in the type of experience accumulated (such as success versus failure experience) or to learning transfer across tasks, units, and organizations (which has in turn be related to factors such as the colocation of development and manufacturing personnel) (Argote, McEvily, & Reagans, 2004; Kim, Krishnan, & Argote, 2012; Lapré & Nembhard, 2010).

Less commonly, learning curve research has also been concerned with the impact of management interventions on the learning curve, including industrial engineering and HRM activities (resulting in induced as opposed to autonomous learning). The impact of HRM activities on the learning curve has arguably been insufficiently studied (Argote et al., 2004; Lapré & Nembhard, 2010). Nevertheless, a handful of studies have also examined how employee training impacts on the learning curve. Adler and Clark (1991) as well as Nembhard and Tucker (2011) found training to temporarily disrupt the learning progress before positive performance effects emerge (after a time lag of two years in Nembhard and Tucker’s study). By contrast, Hatch and Dyer (2004) reported that training “speeds the rate at which human resources learn their duties” (p. 1159). Their finding is consistent with an earlier study by Mukherjee, Lapré, and Wassenhove (1998).

Based on the learning curve literature, it shall then be argued that employee training may
have two types of effect on the learning curve. First, it may induce *learning curve shift*—a more fundamental change to how employees perform a task, entailing that employees need to apply and develop a different set of skills. The change is associated with *incomplete knowledge spillover* in the sense that at least some of the experience and skills developed previously are no longer applicable (Benkard, 2000). This may result in a temporary performance reduction, until equivalent experience is accumulated in relation to the altered skill set (Adler & Clark, 1991).

Second, training may induce *learning curve acceleration*: The learning rate is increased while the set of skills needed to master the task is not significantly changed. For example, leadership training might be effective by altering the predominant leadership style adopted by the managers of an organization—inducing learning curve shift (Barling, Weber, & Kelloway, 1996). Or it might be effective by helping recently promoted junior managers to learn the predominant leadership style of their organization more quickly—inducing learning curve acceleration.

The following sections will develop a model detailing how learning curve shift and acceleration effects of employee training may be associated with different lag effects and effect durations. The term employee training shall be understood broadly, as any planned effort aimed at the enhancement of employee learning with regard to work-related skills, knowledge, and abilities (Berk & Kaše, 2010; Mathieu & Tesluk, 2010).

**3. The link between the training effect type and lag effects at the employee level**

In this section, it will be proposed that the training effect type (learning curve shift versus acceleration) has a bearing on the lag effect at the employee level (the time lag between the training activity and the emergence of beneficial effects on employee performance). In the first instance, the training effect type shall be argued to influence the employee’s relative position on the learning curve: Following learning curve shift effects of training, employees should
generally find themselves at an earlier stage of the learning curve, in comparison with learning curve acceleration effects (which do not place employees at the start of a new learning curve but move them down further on a learning curve they have already been progressing down). The employee’s relative position on the learning curve, in turn, can be argued to influence lag effects in two ways.

First, it can be argued to relate to the time it takes to integrate the newly developed skill in the employee’s repertoire of behavioral routines. Integrating a new skill in an employee’s repertoire requires practice on the job, (a) so that the employee learns to recognize cues that trigger the application of the skill (Gaudine & Saks, 2004) and (b) to adapt the skill to the specific job and organizational context (Ackerman & Heggestad, 1997). It can then be argued that this process of new skill integration takes more time if employees find themselves in an earlier relative position on the learning curve: The evidence suggests that the early learning stages are associated with much trial-and-error, mistakes, and false starts, before a usable repertoire of behavioral routines is developed and before the autonomous learning process gradually picks up speed (Anderson, 1995; Boisot, 1998; Kozlowski, Gully, Nason, & Smith, 1999). At the same time, there is evidence to suggest that employees incorporate new skills more easily at more advanced learning stages, where they develop self-regulatory skills facilitating their reflecting on and making changes to their repertoire of behavioral routines (Smith, Ford, & Kozlowski, 1997; Volet, 1991). Thus, it shall be proposed that training inducing learning curve shift rather than acceleration tends to be associated with longer lag effects, firstly, due to the (initially) slower integration of new skills in the employees’ repertoire of behavioral routines.

Second, the employee’s relative position on the learning curve may also influence how a
training activity relates to synergistic effects among multiple training activities. Strategic HRM research has demonstrated synergistic effects among complementary HRM practices such as selective hiring, extensive training, employment security, and involving job designs (Chadwick, 2010). It is plausible that synergistic effects are also associated with sequences of complementary training activities, that is, foundational and more advanced training activities. If it can be assumed that complementary training activities tend to relate to different stages of the learning curve, one can argue that, at an earlier learning stage, the employee is more likely to engage in foundational training, the effects of which are more likely to (at least partially) depend on the completion of advanced training at a later stage. Vice versa, at later stages of the learning curve, training effects should be less likely to depend on further training activities. Or training may even build on earlier foundational training activities to realize synergistic effects.

Consequently, it can be proposed that training inducing learning curve shift rather than acceleration tends to be associated with longer lag effects also because the full realization of effects is more likely to depend on subsequent, complementary training activities.

Apart from the employee’s relative position on the learning curve, the training effect type may influence the lag effect also due to a factor that shall be referred to as obsolete experience. Learning curve shift renders experience at least partially obsolete, requiring the accumulation of experience in relation to a different skill set. This may result in temporary performance deterioration until a sufficient amount of experience is accumulated in relation to the new skill set, as evidenced by learning curve research (Adler & Clark, 1991; Benkard, 2000; Vits, Gelders, & Pintelon, 2007). This factor—obsolete experience—is, by definition, not applicable given training effects via learning curve acceleration, which do not involve significant change to the skill set applied and developed.
In summary, the training effect type is proposed to influence the lag effect via three mediators at the employee level: new skill integration, synergistic effects, and obsolete experience. This influence shall additionally be proposed to be moderated by task complexity, which shall be defined in terms of the number of component skills constituting the learning curve. That is, a learning curve can be seen to consist of a set of component skills (or proximal learning goals) that need to be developed in relation to the task at hand (e.g., Delaney, Reder, Staszewski, & Ritter, 1998; Lapré & Nemhard, 2010); a more complex task is associated with a longer learning curve, consisting of more component skills to be learned in order to master the task (see also Anderson, 1995; McIver, Lengnick-Hall, Lengnick-Hall, & Ramachandran, 2013). Hence, the more complex the task (the longer the learning curve), the more likely will it require multiple, synergistic training activities at different learning stages. And the greater will be the experience that may potentially become obsolete. Vice versa, given a low level of task complexity, learning curve shift is less likely to entail long lag effects due to synergistic effects or obsolete experience. The difference between the timing of training effects via learning curve shift versus acceleration is then likely to be less pronounced.

Organizational learning curves assume the same power-curved shape as employee-level
learning curves—that is, organizational performance improves with cumulative (organization-level) task experience, at a decreasing rate (Dutton & Thomas, 1984; Lapré & Nemhhard, 2010). Organizational learning is the result of employee-level learning in relation to (a) task performance and/or (b) collaborative processes (Argote et al., 2004; Ingram, 2002; Kim, 1993). A similar argument was made in the training effects literature, where employee-level performance effects of training were argued to impact on organizational performance either directly or via changes in the processes that define how performance contributions of employees combine within and across units (Kozlowski, Brown, Weissbein, Cannon-Bowers, & Salas, 2000).

It can then be argued that, at the organizational level, employee training may be effective through either organizational learning curve shift or organizational learning curve acceleration: Organizational learning curve shift shall be defined as a change in performance processes and organizational routines (across employees), involving a step change in the set of skills being applied and developed at the organizational level. Organizational learning curve shift requires employee-level learning curve shift across multiple employees (Kozlowski et al., 2000). For example, leadership training may be effective by altering the predominant leadership style of an organization, requiring the unlearning and relearning of leadership behaviors across a larger number of managers (Barling et al., 1996).

By contrast, organizational learning curve acceleration effects of training shall be defined as positive effects on the organizational learning rate while the set of skills applied and developed is not significantly altered at the organizational level. Organizational learning curve acceleration may be associated either with learning curve shift or with learning curve acceleration at the employee level. For example, a leadership training may be effective by
helping a newly promoted junior manager to fundamentally alter her leadership style (inducing learning curve shift at the employee level) so as to match the preferred leadership style of her organization and resolve a “bottleneck” caused by her incompatible leadership approach. Or it may be effective by helping her move down a given learning curve more quickly (inducing learning curve acceleration at the employee level), improving the effectiveness of organizational processes and routines in more subtle ways. In either case, the effect at the organizational level will be learning curve acceleration.

On that basis, it shall be proposed that training effects via organizational learning curve shift tend to be associated with longer lag effects than training effects via organizational learning curve acceleration, firstly, because they are more likely to be associated with learning curve shift at the employee level. That is, according to the above argument, organizational learning curve shift necessarily requires employee-level learning curve shift. Organizational learning curve acceleration is likely to be associated with employee-level learning curve shift in some cases and employee-level learning curve acceleration in other cases. Employee-level learning curve shift effects of training were associated with generally longer lag effects than employee-level learning curve acceleration effects in the previous section. Hence, by and large, organizational learning curve shift should be more likely to be associated with the longer lag effects of employee-level learning curve shift than organizational learning curve acceleration.

Secondly, organizational learning curve shift involves change to performance processes and organizational routines across employees. This requires change in shared assumptions, beliefs, and expectations in the organization that define and govern how the contributions of employees are combined within and across the units of the organization. Such shared assumptions, beliefs, and expectations have been studied previously as shared mental models.
Change to shared mental models was shown to involve role negotiation (Brueller & Carmeli, 2011; Garfield & Dennis, 2013; Kozlowski et al., 1999). Role negotiation can be time consuming due to the need to coordinate across long cause-effect chains, interpersonal and intergroup conflicts, and resistance to change (Lorinkova et al., 2013; Marks, Mathieu & Zaccaro, 2001). Role negotiation does not occur at a single point in time but at different times in the collective sense-making process, which requires time itself and is inseparably interwoven with the role negotiation process (Brueller & Carmeli, 2011; Chen & Klimoski, 2007). In other words, it may take time for employees in various parts of the organization to think through and discuss the ramifications of different ways of implementing and coping with the change. And this process of sense-making is informed by and, simultaneously, feeds into the role negotiation process at multiple points in time. Hence, training effects via organizational learning curve shift can be proposed to be associated with longer lag effects, secondly, due to collective sense-making and role negotiation processes—in comparison with organizational learning curve acceleration effects (which improve performance within the confines of existing shared mental models).

Third, training effects via organizational learning curve shift may be more lagging also because the training may have to be “rolled out” across a larger number of employees for effects to emerge—while effects via organizational learning curve acceleration should not hinge on training roll out. A study in the human capital resource literature has yielded that the effects of raised human capital levels (skill levels) on organizational performance depended on human capital being raised across a wider part of the workforce (a “stock” of human capital being built up) (Ployhart et al., 2011; see also Dierickx & Cool, 1989). Applying this finding in the context of the present study, it means employee training may have to be “rolled out” across a larger
number of employees for performance effects to emerge. Rolling out training may take time in particular where the training takes longer and relates to firm-specific skills, such as management trainee and apprenticeship programs (typically taking one to three years to complete). Firm-specific skills demand the involvement of experienced employees in conducting the training (as opposed to the training being conducted by a training provider in the market) (McIver et al., 2013). Given experienced employees with the skills needed to conduct the training are available in limited numbers within an organization, respective training programs must be rolled out cohort by cohort, year after year.

Thus, “training roll out” constitutes a factor that may potentially cause lag effects. This factor shall be proposed to be more likely applicable where training is effective by inducing organizational learning curve shift rather than acceleration. Organizational learning curve shift involves change in performance processes and organizational routines as well as the shared mental models that govern them. This implies that training must change the assumptions and behaviors of more than one employee—according to Ployhart et al. (2011) of a majority of employees in the unit—for effects to emerge at the organizational level (see also Kozlowski et al., 2000). By contrast, organizational learning curve acceleration effects do not involve change in performance processes, organizational routines, and the underlying shared mental models. Hence, performance improvements at the individual level translate directly into performance effects at the organizational level (assuming the training is effective) (Kozlowski et al., 2000). An example of a training effective via organizational learning curve shift might be a management trainee or apprenticeship program when it is first introduced in an organization. Applying the arguments by Ployhart et al. (2011), effects on organizational performance should, at that point, depend on the completion of the program by a larger number of employees over
time (for the “human capital stock” to be built up, for behavior change to emerge on a noticeable scale, and for the organizational learning curve to be shifted). By contrast, training that brings up to speed an underperforming employee (resolving a “bottleneck” in the performance processes and organizational routines of the firm) would be an example of a training effective via organizational learning curve acceleration, the effects of which should not depend on the training being rolled out (Kozlowski et al., 2000).

In summary, the training effect type at the organizational level is proposed to relate to organizational-level lag effects via the employee-level training effect type, collective sense-making and role negotiation processes, and training roll out. Its impact shall additionally be proposed to be moderated by task complexity (represented by the length of the learning curve, that is, the number of component skills to be learned in order to master the task). A more complex skill is likely associated with more extensive training (covering more component skills), which is likely to result in a longer training roll out process, according to the above arguments. In a similar vein, changing shared mental models in relation to more complex tasks is likely to be associated with a longer collective sense-making and role negotiation process (relating to a greater number of component tasks and corresponding work processes). For example, Nembhard and Tucker (2011) reported on a training program inducing a complex change affecting 93 different work processes across different hospital units. This type of training will likely involve both longer sense-making and negotiation processes and longer training roll out than, for instance, a training introducing a new office supplies ordering process (inducing organizational
learning curve shift on a smaller scale).

5. The link between the training effect type and the training effect duration at the employee level

The extent to which employee training constitutes an investment in future performance depends, apart from lag effects, also on the effect duration, that is, the extent to which positive effects are recurring rather than temporary. In this respect, the learning curve logic implies that effects via learning curve acceleration should generally be temporary while effects via learning curve shift may potentially be lasting. Learning curve acceleration gives employees metaphorically speaking a “head start” in moving down the learning curve, compared to employees in a scenario without training. This advantage will gradually be reduced as the employees approach the learning curve plateau, at which most employees will have developed most component skills through experience and informal learning (Dutton & Thomas, 1984). By contrast, learning curve shift raises the learning curve plateau to a level not reached in a scenario without training. Hence, one can propose a direct, unmediated relationship between the training effect type and the effect duration at the employee level.

Additionally, this relationship shall be proposed to be moderated by job tenure, the half-life of knowledge, and task complexity. Job tenure (or employee turnover) is commonly
mentioned as a factor constraining the training effect duration (e.g., Boudreau, 1983; Lapré & Nembhard, 2010). The “half-life of knowledge” can be defined as the amount of time over which the trained skill is applicable on the job. It relates (inversely) to change in technology and in products or services marketed, advancements in professional expertise, and temporary needs for skills. The consequence of a limited half-life of knowledge is what the learning curve literature refers to as organizational forgetting: The relationship between cumulative task experience and performance is weaker to the extent task experience dates back far (Benkard, 2000; Kleiner, Nickelsburg and Pilarski, 2012; Thompson, 2007). Thus, if the job tenure or the half-life of knowledge tends to be short, training effects are more likely to be temporary, not only given learning curve acceleration but also given learning curve shift effects. Finally, task complexity is defined in terms of the number of component skills constituting the learning curve (see also Anderson, 1995; McIver et al., 2013). Effects via learning curve acceleration (giving employees a head start in moving down the learning curve) should last longer given a longer learning curve (or, more specifically, a longer learning curve segment from the point at which the training is provided to the learning curve plateau). The difference in the effect duration between learning curve shift and acceleration effects should then, generally, be inversely related to the length of the learning curve (from the point at which the training is provided to its plateau).

Insert Figure 7 About Here

6. The link between the training effect type and the training effect duration at the organizational level
This section is concerned with the link between the type of training effect on the organizational learning curve (shift versus acceleration) and the effect duration at the organizational level. The first mediator of this link shall be proposed to be the employee-level training effect type, analogous to the earlier argument: Organizational learning curve shift is necessarily associated with employee-level learning curve shift. Organizational learning curve acceleration may be associated with either employee-level learning curve shift or employee-level learning curve acceleration. According to the previous section, employee-level learning curve shift tends to be associated with a longer effect duration (in comparison with employee-level learning curve acceleration). Hence, one must expect that training effects via organizational learning curve shift tend to be associated with the longer effect duration of employee-level learning curve shift, as a general trend and in comparison with effects via organizational learning curve acceleration.

A second potential mediator of the link between the training effect type and the effect duration at the organizational level is the reversibility of the change effected by the training. This factor can be related to a phenomenon referred to as learning decay in the literature. That is, it may occur that employees use trained skills on the job for a limited period of time and then revert to behaviors adopted prior to the training (Blume et al., 2010; Taylor, Russ-Eft, and Chan, 2005). Learning decay can be interpreted from the perspective of this study as follows: Given employee-level learning curve shift effects, learning decay implies that employees revert to the learning curve they were progressing down prior to the training. By contrast, given employee-level learning curve acceleration effects, learning decay implies that employees cease to apply a new component skill while remaining on the same learning curve. That is, following the training, their performance initially improves at a more rapid pace. Then performance either
regresses to the pretraining level or—assuming continuous experience-based learning—it develops at a slower pace. In relation to learning curve shift effects at the organizational level, learning decay implies that multiple employees revert to pretraining learning curves as well as the undoing of change to shared mental models. Finally, given learning curve acceleration effects at the organizational level, learning decay may imply any of the following: a reversal of employee-level learning curve shift, a reversal of employee-level learning curve acceleration, and fluctuation among trained employees.

On that basis, it shall then be proposed that a reversal of organizational learning curve shift effects is less likely than a reversal of organizational learning curve acceleration effects. Organizational learning curve shift but not acceleration effects involve change to organizational routines and the shared mental models that govern them. The reversal of change to shared mental models is less likely than the reversal of change within the confines of existing shared mental models for three reasons (Gersick, 1991). First, change to shared mental models—once accomplished—involves change in cognition, which has a stabilizing effect on new shared mental models and the corresponding processes and routines. Second, changing shared mental models involves employee investments in terms of effort and discomfort (for instance related to sense-making and role negotiation processes). Consequently, the employees’ motivation to revert to prior shared mental models may be low. Third, different shared mental models are associated with different networks of obligations among employees, locking shared mental models into a stable equilibrium. These arguments by Gersick (1991) are supported by evidence in so far as major organizational change was shown to be typically followed by longer periods of stability (Langley, Smallman, Tsoukas, & Van de Ven, 2013; Lorinkova et al., 2013; Summers, Humphrey, & Ferris, 2012). On that basis, it can be proposed that training effects are likely to be
longer given organizational learning curve shift (rather than acceleration) effects because the effected change is less likely to be reversed, that is, learning decay should be less likely.

The link between the training effect type and the reversibility of change (and consequently learning decay) shall furthermore be proposed to be moderated by task complexity. Learning curve shift in relation to a more complex task (involving a larger number of component skills) should involve more extensive change of employee assumptions and cognition, more extensive employee investments in terms of effort and discomfort (sense-making and role negotiation processes in relation to a greater number of component processes), and more extensive change to obligation networks—rendering reversal to prior organizational learning curves more costly and less likely. Vice versa, given low levels of task complexity, the reversal of organizational learning curve shift should be less costly and more likely, entailing less pronounced differences in the effect duration between organizational learning curve shift and acceleration effects.

7. Training that is effective by preempting unintended change

Apart from performance improvement effects, training may also be effective by sustaining the “human capital resource” of the organization (its aggregate skills) and, thus, preempting organizational performance deterioration against the backdrop of employee turnover.
(Dierickx & Cool, 1989; Ployhart et al., 2011). To interpret this type of training effect from the learning curve theoretical perspective of this study, one needs to consider what happens if an organization suspends the respective training activity. If an organization suspends a regular training activity, such as a management trainee or apprenticeship program, it may, as a first possibility, incur unintended organizational learning curve shift. That is, given employee turnover, vacancies may be staffed with insufficiently trained and developed employees and such employees may start to question, negotiate about, and ultimately change their unit’s work processes, organizational routines, and shared mental models. The research evidence supports both (a) that the joining of a unit or work group by new employees may trigger such negotiations and consequent change (e.g., Garfield & Dennis, 2013; Summers et al., 2012) and (b) that the outcome of this change may be less effective work processes and organizational routines, especially if the new employees are insufficiently trained and prepared for the specific context of their job and organization (Boisot, 1998; Boisot, MacMillan, & Han 2007). Alternatively, as a second possibility, the staffing of vacancies with less trained, less skilled employees might result in what shall be referred to as unintended organizational learning curve deceleration rather than shift. That is, new job incumbents may progress down the same learning curve as their predecessors while they have mastered fewer skill components, performing the same processes and routines at a lower level of effectiveness. Whether the staffing of vacancies with insufficiently trained employees results in unintended organizational learning curve shift or deceleration may depend on factors such as the amount of job discretion (e.g., Taylorist versus enriched or team-based forms of work organization), the amount of turnover (a larger number of new employees might be more likely to effect unintended organizational learning curve shift—see also Ployhart et al., 2011), the amount of time for which the training is postponed, and the
strength of professional norms governing work processes and routines where professional work is affected (Argote & Ophir, 2002; Freidson, 2001).

It can then be argued that the earlier developed model of the timing of training effects is applicable, too, where training is effective by sustaining rather than improving organizational performance. That is, whether training is effective by preempting unintended organizational learning curve shift or by preempting organizational learning curve deceleration should have a bearing on lag effects via two of the earlier proposed mediators. Lag effects may conceivably be influenced by collective sense-making and role negotiation processes—given training preempts unintended organizational learning curve shift: Following a reduction of respective training activities, shared mental models are unlikely to change instantaneously as positions are staffed with less skilled employees. Experienced employees may uphold the existing organizational routines for some time. Any change to shared mental models will likely involve processes of questioning, negotiating, and collective sense-making before new routines become established (Lorinkova et al., 2013; Summers et al., 2012). By contrast, where the reduction of training results in organizational learning curve deceleration, the effect does not depend on change to shared mental models or the sense-making and role negotiation processes associated with it.

Apart from collective sense-making and role negotiation, unintended organizational learning curve shift may also depend on lower levels of skill and experience being “rolled out” across a greater number of employees. That is, employee turnover tends to be a gradual process, reducing aggregate skill levels (the “human capital resource”) one employee at a time. (Unintended) organizational learning curve shift, however, requires change in assumptions, beliefs, and expectations across a larger number of employees (Ployhart et al., 2011)—skill levels need to be reduced across multiple positions. By contrast, less effective performance of
existing processes and routines may in principle result from skill reductions in a single job (e.g., reduced sales in a sales job or emergence of a “bottleneck” due to inadequate performance behaviors of an employee) (Kozlowski et al., 2000).

Thus, two of the earlier proposed organizational-level mediators of lag effects should be applicable not only where training improves but also where it sustains organizational performance. The earlier proposed employee-level mediators of lag effects, however, can be argued to not be applicable where training is effective by sustaining instead of improving organizational performance. The reduction of skills at the employee (job) level occurs instantaneously with the replacement of a fully trained employee by an insufficiently trained employee—both in the context of training being effective by preempting unintended organizational learning curve shift and in the context of training being effective by preempting organizational learning curve deceleration (although the effect may be buffered at the organizational level if the organization has previously built up a pool of skilled employees exceeding their immediate demand). Nevertheless, due to collective sense-making and role negotiation processes as well as the time it may take to “roll out” lower levels of skill, lag effects are likely to be longer to the extent training is effective by preempting unintended organizational learning curve shift rather than organizational learning curve deceleration.

Finally, training effects via sustained (as opposed to improved) organizational performance trajectories are also subject to the earlier arguments pertaining to differences in the training effect duration. If the postponement of a regular training activity results in employees progressing down the same organizational learning curve more slowly (organizational learning curve deceleration), they may be able to “catch up” as they accumulate task experience, learn informally, and receive training at a later point in time (in comparison to a scenario in which
training is provided throughout). However, if the failure to train results in a shift to a less effective learning curve, performance will plateau at a lower level (in comparison to the continuous training scenario). Moreover, once unintended organizational learning curve shift has occurred, the altered shared mental models associated with it should render a reversal of the shift costly (Gersick, 1991). In summary, the final proposition of this paper shall be that training that preempts unintended organizational learning curve shift tends to be associated both with longer lag effects and with longer effect durations than training that preempts organizational learning curve deceleration.

8. Discussion

This paper contributes to recent literature concerned with relationships between various types of HR investment and future firm performance (Edmans, 2012; Krausert, 2014; Nyberg, Pieper, & Trevor, forthcoming; Ployhart et al., 2011). It has been argued that future-oriented HR investments should be of interest to investors in the capital market as signals of future earnings growth (Hendry, Woodward, Harvey-Cook, & Gaved, 1999; Edmans, 2011; Krausert, forthcoming). If investors do attend to respective HR investments, so the argument, their performance effects will be factored into investor expectations and, consequently, the stock price (Edmans, 2009, 2011; Cohn, Khurana, & Reeves, 2005). This should, in turn, improve the ability of managers to support HR investments without incurring a near-term penalty in their stock-based compensation and job security (Gentry & Shen, 2013). Hence, work has been undertaken to develop an HRM signal for the capital market, which is intended to signal to investors whether a firm has made HR investments predictive of future earnings (Krausert, forthcoming). What is still lacking is a comprehensive understanding of which HRM activities should and which ones should not be considered future oriented. A type of HRM activity that is
often thought to be future-oriented is employee training (e.g., MacDuffie & Kochan, 1995; Porter, 1992). However, the evidence is both limited and mixed, some studies suggesting lagging effects (Bartel, 1994; d’Arcimoles, 1997; Nembhard & Tucker, 2011; Ployhart et al., 2011), others suggesting immediate effects of employee training (Aguinis & Kraiger, 2009; Taylor et al., 2005). Similarly, the available evidence concerning the training effect duration partly suggests temporary effects (Blume et al., 2010; Holzer, Block, Cheatham, & Knott, 1993; Murray & Raffaele, 1997), partly lasting effects (Aguinis & Kraiger, 2009; Taylor et al., 2005; Sung & Choi, 2014).

The first contribution of this paper is a theoretical model providing grounds to argue that the timing of training effects may systematically differ depending on whether training induces organizational learning curve shift or organizational learning curve acceleration. That is, organizational learning curve shift effects of training were argued to be associated with both generally longer lag effects and a generally longer effect duration. By contrast, training inducing organizational learning curve acceleration was argued to have a more immediate as well as a more temporary effect. It can then be argued further that training inducing organizational learning curve shift should be particularly relevant for the work undertaken in relation to the HRM signal for the capital market, especially where the training relates to relatively complex tasks and where both the job tenure and the “half-life of knowledge” tend to be reasonably long. Training impacting via organizational learning curve acceleration should by and large have a more immediate effect and, hence, be of less concern from a corporate governance point of view (the effect is more likely to be reflected in near-term earnings, which are linked to managerial incentives in immediate ways). It was furthermore argued that training can be effective not only by inducing positive change effects but also by preempting unintended change. If training is
effective by sustaining rather than improving organizational performance trajectories, it should be associated with both a longer lag effect and a longer effect duration to the extent it preempts undesirable organizational learning curve shift rather than deceleration. Respective training activities should then also be taken into account for the HRM signal for the capital market.

As a second contribution, the study proposed a multilevel model offering a comprehensive explanation of how and under what circumstances various factors influence the timing of training effects. The model encompasses mediators and moderators of the link between the training effect type on the one hand and lag effects and the effect duration on the other—both at the employee and organizational levels. This is the first model to offer a comprehensive explanation of why the timing of training effects may differ across training activities. To be sure, the prior literature does encompass a number of factors explaining why effects may be lagging or why effects may be temporary as opposed to lasting. However, it has not been suggested that (or how) these factors might apply differentially across types of training.

Finally, as a third contribution, this study has covered a wider range of influences on lag effects and the effect duration than the prior literature. Potential causes of lag effects in the prior literature include, in essence (often implied rather than explicit), the integration of new skills in an employee’s repertoire of behaviors (in the training transfer literature: e.g., Blume et al., 2010; Gaudine & Saks, 2004; Sitzmann & Weinhardt, forthcoming). They include the accumulation of a stock of human capital (in the human capital resource literature: e.g., Dierickx & Cool, 1989; Ployhart et al., 2011; Ployhart, Weekley, and Ramsey 2009)—broadly corresponding to the training roll out construct in the current study (while the current study provides a more specific explanation of why the accumulation of human capital stock may require time). Lag effects related to, in essence, collective sense-making and role negotiation processes were mentioned by
Kozlowski et al. (2000) (in the training effects literature). Finally, obsolete experience was covered as a potential cause of lag effects in the learning curve literature (Adler & Clark, 1991; Nembhard & Tucker, 2011). Beyond these factors, this study has proposed synergistic effects among multiple training activities as an additional potential cause of lag effects. The relative position on the learning curve was proposed as an antecedent of time to new skill integration and synergistic effects among multiple training activities. Task complexity was proposed as a moderator. With respect to influences on the effect duration, the training effects literature has predominantly been concerned with learning decay (Blume et al., 2010; Salas & Cannon-Bowers, 2001; Taylor et al., 2005) and employee turnover (Boudreau, 1983; Schmidt, Hunter, & Pearlman 1982). Beyond that, this study proposed a direct effect of the training effect type on the effect duration at the employee level and the reversibility of change as a mediator at the organizational level (as well as tenure, the half-life of knowledge, and task complexity as moderators). Hence, the study provided not only a model integrating various factors to explain how temporal effects of training may differ across types of training but it also provided a more comprehensive perspective on potential influences on the timing of training effects in comparison with the prior literature.

The study opens up a number of avenues for further research. For example, one could examine a wider range of specific training activities of organizations and determine to what extent they are effective by inducing learning curve shift versus acceleration. One could examine to what extent learning curve shift and acceleration at the employee level relate to learning curve shift and acceleration at the organizational level. One could examine to what extent different training activities are effective by inducing intended change versus preempting unintended change. One could study the proposed mediators and moderators, relating them to
different training activities, training effect types, lag effects, and the training effect duration. Based on a better understanding of the relative importance of various influences on lag effects and the effect duration, one might explore measures to minimize lag effects and maximize the effect duration.

From a corporate governance point of view, one could study influences of the training effect type, the various mediating and moderating factors, and the lag effect and effect duration on decisions to invest in training. One could study such influences in the presence of near-term performance pressures (for instance related to quarterly earnings targets) and in their absence. One might relate firm expenditures on different types of training activity to long-term returns on investment in the capital market. Bassi and McMurrey (2005) obtained abnormal long-term returns on investment for a portfolio of firms selected on the basis of their training expenditures. Following the present study, one might select portfolios of firms based on their expenditures across different types of training activity in order to examine differences in the earnings predictability of these types. The study then provides an input for the development of an HRM signal for the capital market (Krausert, forthcoming). In that context, further work could, for instance, seek to provide a comprehensive listing of specific training activities with near- versus longer-term effects, specifying expected lag effects and effect durations. One could examine how those collating the HRM signal might obtain reliable information about respective training activities and how the coverage of respective training activities by the HRM signal affects training investment decisions (see also Hoque, 2003; Hoque & Bacon, 2008).

Finally, future research could examine some factors that had to remain outside the scope of this study. First, the scope of the study was confined to the employee and organizational levels. Future research could examine additional factors that may influence the timing of
training effects at the financial level. Such factors were previously covered by a literature conducting economic utility analyses of training. This literature was not concerned with the timing of training effects as such or differences across types of training activity. However, it did include the training effect duration as a factor influencing the economic utility of training as well as a number of antecedents of the training effect duration at the financial level, such as rising wages in the wake of training, tax-related factors, the cost of capital, and rates of return on alternative investment opportunities (e.g., Birati & Tziner, 1999; Boudreau, 1983). Future research should take into account such factors and their interaction with the factors covered by the current study. Related to that is the question whether returns on training investment are appropriated by the firm (through higher profits) or by employees (through higher wages), where research in economics and industrial relations suggests it tends to be the former (e.g., Ballot, Fakhfakh, & Taymaz, 2006; Bartel, 2000). Representing yet another factor above the organizational level, future research could also study the timing of training effects contingent on whether performance improvement effects lead to increased productivity (that is, ultimately, reduced costs at the financial level) or improved product/service attributes (ultimately improved revenues).

Second, another subject outside the scope of this study was training effects via employee attitudes. While this study was focused on training effects via employee learning, there is evidence to suggest that training may also have effects via organizational commitment, employee motivation, morale, effort, employee turnover, and absenteeism (Galunic & Anderson, 2000; Tharenou et al., 2007). In a related vein, training activities might influence the employer attractiveness of a firm. It is likely that the timing of training effects via employee attitudes and employer attractiveness differs from the timing of effects via learning. Yet another factor not
directly related to learning is time gaps between the training and the application of developed skills on the job. For example, leadership development programs for nonmanagerial employees might have little bearing on current job performance—effects might start to emerge only as and if the employees are promoted into managerial positions. Related to that, another factor may be organizations building up pools of employees with certain skills beyond their immediate demand. This may potentially create a buffer mitigating negative effects of the postponement of training activities for some time. Thus, future empirical research should examine a wider range of influences on temporal effects of training, including the factors that were derived through the learning curve theoretical perspective of this study and other factors.

Apart from providing a basis for further research, this study provides immediate practical guidance where empirical research may (currently) not be able to provide needed answers. Specifically, as discussed above, it should guide efforts to develop and establish an HRM signal for the capital market. Related to that, a better understanding of the timing of effects of various training activities may also provide a basis for more effective direct communication between managers and the investment community (Krausert, forthcoming; zu Knyphausen-Aufseß, Mirow, & Schweizer, 2011). That is, the managers’ ability to credibly communicate about effects of intangibles investments on future earnings may enable investors to better distinguish current earnings that are low due to bad management from earnings that are low because the firm has made necessary HR-related investments. Ultimately, this may enable managers to support investments in employees without incurring a near-term penalty in their stock-based compensation and job security (Gentry & Shen, 2013).

Based on the model developed with this study, the communication between managers and investors should cover training activities aimed at changing existing ways of working in an
organization, be it by changing the predominant leadership style of an organization (Barling et al., 1996), cross-unit interaction patterns (Nembhard & Tucker, 2011), or levels of employee involvement (Birdi et al., 2008). Another type of training activity their communication may cover is training programs aimed at building up skills across the workforce (or a segment of the workforce), such as management trainee and apprenticeship programs. Such programs may be associated with lag effects in particular when they are first implemented, requiring the rolling out of higher levels of skill across the workforce, collective sense-making and role negotiation processes associated with emerging better ways of working, as well as learning processes at the employee level: Respective training programs typically encompass a sequence of synergistic training activities and they require a larger number of skill components to be integrated in the employees’ repertoires of behavioral routines (see also McIver et al., 2013). Once they are established in the organization, such training programs should serve to sustain rather than improve organizational performance trajectories. Nevertheless, they may potentially still be considered future-oriented HR investments since postponing respective training activities too far—coupled with employee turnover—might result in unintended change to the ways of working in the organization, which might be difficult to reverse once new routines have taken hold. Hence, firm communications with the capital market might encompass such training program not only when they are first implemented but also when they are sustained by a firm for instance during an economic downturn (especially if they are suspended by other firms at the same time). Regardless of changed ways of working at the organizational level, training activities might also need to be accounted for as future-oriented if they are associated with substantial lag effects at the employee level, caused by synergistic effects among multiple training activities, new skill integration, and obsolete experience given employee-level learning
curve shift.
References


organizations (pp. 642-663). Malden, MA: Blackwell.


zu Knyphausen-Aufseß, D., Mirow, M., & Schweizer, L. (2011). The role of financial analysts in...
the strategy formation process of business firms. *Industrial and Corporate Change*, 20, 1153-1187.
Figure 1: Learning curve
Figure 2: Mediators of the link between the training effect type and lag effects at the employee level
Figure 3: Moderator of the link between the training effect type and the lag effect at the employee level
Figure 4: Mediators of the link between the training effect type and the lag effect at the organizational level
Figure 5: Moderator of the link between the training effect type and the lag effect at the organizational level
Figure 6: Direct effect of the training effect type on the effect duration at the employee level
Figure 7: Moderators of the link between the training effect type and the effect duration at the employee level
Figure 8: Mediators of the link between the training effect type and the effect duration at the organizational level
Figure 9: Moderator of the link between the training effect type and the effect duration at the organizational level