How Strong Is the Effect of Learning in the Workplace?

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ABSTRACT

Volatility, uncertainty, complexity and ambiguity characterize the environment of knowledge-intensive organizations today. The "survival of the fittest" demands those organizations act as living organisms and adapt to environmental changes. It is no longer sufficient for them to think that employees' competences at the time of recruitment will meet future demands. New technologies are rapidly transforming job landscapes and reshaping the way people work within organizations. Accordingly, organizations are investing in further training of their employees. This investment raises a question: How does learning interact with skills application and operational excellence in the workplace? This research aims to explore the relationship between learning and operational excellence in the workplace by utilizing the mediating role of skills application. The sample data sets of 3,730 employees from a 2015 survey of a multinational knowledge-intensive company were used to perform mediation analysis using regression-based tests and bootstrapping. The findings show that learning affects operational excellence by affecting skills application. The measured effects are positive and significant, however, they are very small. These results suggest that learning and skills applications are only two of many factors which may influence operational excellence. This research is relevant for knowledge-intensive organizations to understand that learning activities in the workplace alone are not enough to boost operational excellence.

Keywords: human capital, in-company training, skills application, operational excellence, knowledge-intensive organizations

Introduction

What is crucial for organizations today is not who is the most proficient in designing a drawing or making a competitor analysis but instead, the social competencies an employee possesses are what matter most (World Economic Forum, 2016, pp. 19–27). In 2011, 80.2 % of the non-formal adult education and training in the member countries of the European Union were job-related and a high share thereof, 70.8 % were financed by employers, who used training as an instrument to build up knowledge and skills of employees (Eurostat, 2015). A report from the

Organisation for Economic Co-operation and Development pointed out that non-formal education and training activities provided by employers has the reputation of being one of the largest areas of lifelong learning (OECD, 2017, pp. 316–322). On average, companies spent 1,075 dollars per employee and employees received 47.6 hours of training (Training, 2017, pp. 20–33). (World Bank Group, 2018) published the aggregated survey results between the years 2009 and 2018 related to workforce characteristics of more than 135,000 firms from 139 countries. The insights are that 20.9% of the firms identified an inadequately educated workforce as a major constraint and 33.6% of the firms are offering formal training to their employees. Workplace training is a global market and a profitable business for training institutes, coaching and consulting firms. It is estimated that corporations spent in 2017 around 362 billion US dollars on corporate training activities worldwide (Statista, 2018). This behaviour raises the research question: how strong is the effect of learning in the workplace? Does employee learning in the workplace increase operational excellence through application of skills? To answer this question, the paper presents a review of the theoretical and empirical concepts of learning, skills application and operational excellence in the workplace, and consequently derives a theoretical model and hypotheses to be tested empirically. Next, it describes the chosen methodological approach and demonstrates the results of the performed empirical analysis. Conclusions and recommendations for future research will be drawn at the end of this paper.

Conceptual fundamentals

This chapter focuses on explanations of the terms “learning”, “skills” and “operational excellence”. Next, it reviews empirical studies related to investment in learning in the workplace.

1.Learning and skills application as an aspect of human capital

The Chicago School representatives, Jacob Mincer, Gary S. Becker, Theodore W. Schultz, integrated Human Capital Theory into economic analysis and developed it substantially. The focus of their analyses was related to the microeconomic approach and targeted to the investment in human beings, e.g. in knowledge and skills acquisition through education and training. This kind of investment involves costs and benefits and can, therefore, be elaborated under investment-theoretical aspects as economic decisions (Becker, 1993; Mincer, 1962, 1975; Schultz, 1959, 1960, 1972). Today, acquisition of human capital and learning, especially in knowledge-intensive companies, is an integral part of Human Resource Management. The former director of Human Resources at Nokia defines learning as “[..] a process in which the individual gathers new knowledge, skills, attitudes, experiences and contacts that produce changes in his/her behaviour” (Sydänmaanlakka, 2002, p. 16).

Training functions as an instrument to provide new knowledge to employees in the workplace. “Training consists of an organization´s planned effort to help employees acquire job-related knowledge, skills, abilities, and behaviors, with the goal of applying these on the job” (Noe, Hollenbeck, Gerhart, & Wright, 2011, p. 223). Thus, skills application is related to the ability to apply acquired knowledge (North, Reinhardt, & Sieber-Suter, 2018, pp. 42–43). In line with the research question, the focus lies on learning in the workplace, which takes place through in-company training, experience, etc. and which leads to accumulation of human capital in the form of skills and, consequently, its application.

2. Operational excellence and how it is defined

Companies use the term “Operational Excellence” widely in practice. However, there is no theory of operational excellence available. In business practice, it can be aligned with Total Quality Management (TQM), Lean Management, "Kaizen" philosophy or Continuous Improvement Process (CIP). Kaizen comes from the thinking that no day should pass without improvement in the organization: Every product, every process, every activity can still be further improved, so that the customer is sustainably satisfied (Imai, 1992, pp. 23–24). CIP intends for all organizational members to learn continuously in order to be adaptable to changing requirements on the one hand and on the other hand to improve the existing requirements. Here, the customers are the important orientation, because they decide on the quality of the products and services (Imai, 1992, pp. 78–80). For example, Toyota has made the principle, "Do the right thing for the company, its employees, the customer, and society as a whole" (Liker, 2004, p. 72). The customer is at the centre of Toyota's organizational goals, and its needs are placed at the beginning of the product development and production process. The first question in the Toyota Production System is: "What does the customer expect from this process?" (Ohno, 1988, pp. 8–9). It is constantly trying to optimize and improve the quality of the process, since the quality assurance of the process ensures the quality of the finished product. Therefore, the continuous improvement activities in the organization must aim for both product and process quality. With this, operational excellence is about process, customer and quality. For example, (Năftănăilă, Radu, & Cioană, 2013, pp. 138–139) defined an operational excellence model which targets the following areas: process, customer and world-class performance. In focus of this research is operational excellence expressed through customer needs.

3. Empirical studies

Some 74 empirical studies from 1972 till 2018 on learning effects in the workplace were analyzed with regard to their effects, their methodology and results. In 61 analyzed studies, training was defined as an independent variable. Depending on the study, this denoted formal and informal training, on-the-job and off-the-job training, continuous training, employer-

provided training, etc. However, the exact definition of training was not always provided, e. g. (Anitha & Kumar, 2016; Büchel & Pannenberg, 2004; Dearden, Machin, Reed, & Wilkinson, 1997). 7 studies defined independent variables as competence, knowledge or mix of training and development measures, e. g. (Chien, 2013; Suharno & Despinur, 2017; Sung & Choi, 2014). Performance and productivity were frequently used dependent variables, e. g. (Jones, 2008; Marin-Diaz, Llinas-Audet, Chiaramonte-Cipolla, & Escardibul, 2014; Sendawula, Kimuli, Bananuka, & Muganga, 2018). The number of empirical studies on measuring the relationship between training and skills or capabilities, competence, behavior is relatively modest, 11 studies were identified, e. g. (Fu, Yi, & Zhai, 2013; Ng & Dastmalchian, 2011). Effects on operational excellence dimensions such as product and process quality, customer service etc. were measured in 4 investigations, e. g, (Dostie, 2014; Shen & Tang, 2018). The link between the independent variable "training" and dependent variables was measured in most of the studies as a one to one relation and mediating variables such "skills application" were not considered. One of the exceptions is the study by (Yang, Fang, & Huang, 2017) which demonstrated a mediating role of competencies between training and task performance and proved a significant effect of professional competency, technical competency, and core competency on the link between training and task performance. The review of empirical studies from different countries has shown that human capital and human capital analysis has been treated very differently by scientists globally. Various authors emphasize one or another aspect of human capital and its effects, considering their specific research goals, challenges and contexts. The overview of 74 analyzed empirical studies with respective variables and effects is outlined in Appendix A.

Methodology

Against this background of the research aim and research questions, the hypotheses to be tested are formulated as follows:

Learning has a significant positive impact on operational excellence (Hypothesis 1).

Skills application mediates positive impact of learning on operational excellence, significantly (Hypothesis 2).

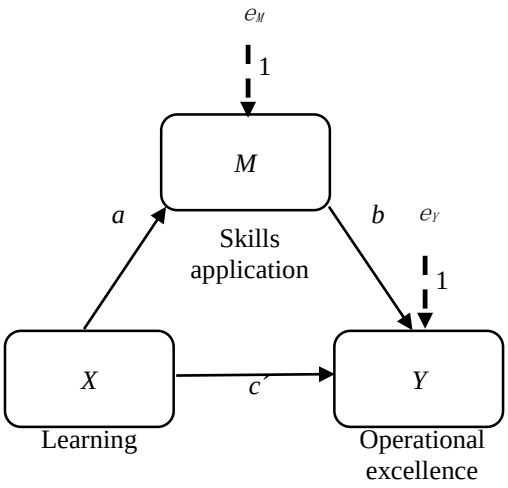
Impact of learning on operational excellence through skills application is significantly stronger than the direct effect of learning on operational excellence (Hypothesis 3).

The positivism paradigm forms the core of the research design. Selected, secondary, quantitative data of a 2015 employee survey from an operational unit of a knowledge-intensive company were utilized for the analysis. The response rate of the survey was approximately 65%, which led to the sample of 3,730 employees from different organizations and countries of the operational unit. The survey statements were evaluated by the participants on the basis of a

five-point Likert scale of how much each statement applies (from "agree" to "disagree"). As analysis method, the mediation analysis using regression-based tests and bootstrapping of the selected data sets was chosen to test the derived hypotheses and executed in IBM SPSS Statistics 25. Concretely, the data generated from the response to the following three statements of the employee survey were processed: 1). There are continuous learning opportunities for me to improve my skills for my current and future jobs. 2). I fully apply my skills and abilities in my work. 3). In my organizational unit we do an excellent job anticipating new products, solutions and services that our internal and external customers will value.

The variable “Learning” is measured by using the data of the first statement, the variable “Skills application” by using the data from the second statement and the variable “Operational excellence” by using the data from the third statement. Accordingly, the research model to test the defined hypotheses is designed in Figure 3.1 in alignment with (Hayes, 2018, pp. 77–86):

Figure 3.1: Statistical diagram of the mediation model with a single mediator variable “Skills application” causally located between “Learning” and “Operational excellence”



Source: (own illustration)

The variables “Skills application” and “Operational excellence” are consequent variables and the variables “Learning” and “Skills application” are antecedent variables, with “Learning” casually influencing “Operational excellence” and “Skills application”, and “Skills application” casually influencing “Operational excellence”. This statistical diagram represents two equations, Eq. 3.1 and Eq. 3.2:

$$M = i_M + aX + e_M \quad (3.1)$$

$$Y = i_Y + c'X + bM + e_Y \quad (3.2)$$

with i_M, i_Y = regression constants, e_M, e_Y = errors in the estimation of *M* and *Y*, *a, b* and *c'* = regression coefficients given to the antecedent variables, *M* = skills application = mediator variable, *Y* = operational excellence = consequent variable, *X* = learning = antecedent variable.

In this model, there are two pathways by which *X* or learning can influence *Y* or operational excellence. Direct effect from learning on operational excellence without passing through skills application, Eq. 3.3:

$$c' = [\hat{Y} \mid (X = x, M = m)] - [\hat{Y} \mid (X = x - 1, M = m)] \quad (3.3)$$

with *m* = any value of *M*, x = any value of *X*, $\hat{Y}$ = estimated or expected from the model. Indirect effect of learning on operational excellence through skills application. The indirect effect represents how operational excellence is influenced by learning through a casual sequence in which learning influences skills application, which in turn influences operational excellence. The indirect effect is the product of a and b, Eq. 3.4 and 3.5:

$$a = [\widehat{M} \mid (X = x)] - [\widehat{M} \mid (X = x - 1] \quad (3.4)$$

$$b = [\hat{Y} \mid (M = m, X = x)] - [\hat{Y} \mid (M = m - 1, X = x)] \quad (3.5)$$

with $\widehat{M}$ = estimated or expected from the model.

The total effect of learning on operational excellence is *c,* Eq. 3.6:

$$c = [\hat{Y} \mid (X = x)] - [\hat{Y} \mid (X = x - 1] \quad (3.6)$$

The total effect is equal to sum of direct and indirect effects of learning, Eq. 3.7:

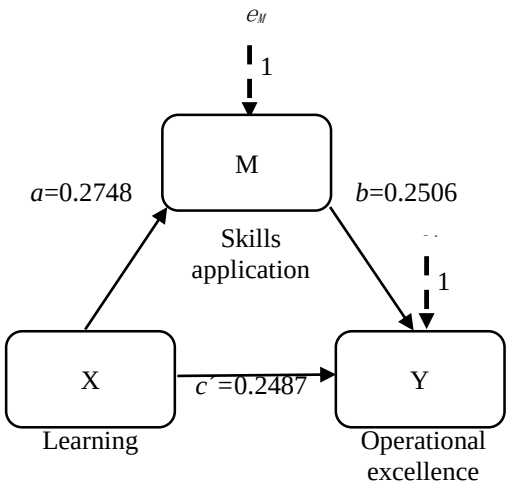
$$c = c' + ab \quad (3.7)$$

Results

Before the selected data set was included in the immediate analysis, it was examined for missing values, outliers and extreme values. In addition, the fulfillment of normal distribution assumptions and assumption of homoscedasticity was tested. The percentage of missing data in the data set was less or equal to 0.6% per each variable. The analysis of the pattern missing values has shown that there was no systematic failure mechanism and the missing values occurred purely by chance, i.e. missing completely at random (MCAR). In this situation, it was decided to perform the listwise deletion of missing values. In summary, 44 cases (1.2%) were deleted and 3,686 cases were left after deletion for the analysis. The statistics on missing values and values for processing is documented in Table 4.1 and Table 4.2 of Appendix B. Next, the data set was checked for statistical univariate outliers and extreme values. Given that all values identified as outliers or extremes were within the normal range, neither outliers nor extreme values were removed from the dataset. An overview of the estimated skewness and kurtosis

values of all three variables is provided in Table 4.3 of Appendix B and a deviation from the normal distribution assumption can be assumed. The skewness values can be interpreted as moderatetely skewed till highly skewed. The kurtosis value for "Skills application" can be described as a population with very likely positive excess kurtosis. For "Learning" and for "Operational excellence," no conclusion about the kurtosis could be reached, excess kurtosis might be positive, negative, or zero. This result is unsurprising because, strictly speaking, the data collected using rating scales violates the assumptions of normal distribution. Homogeneity of variances was asserted using Breusch-Pagan Test which showed that equal variances could not be assumed as demonstrated in Table 4.4 of Appendix B. Therefore, the heteroscedasticity-consistent inference, Typ HC3 (Davidson-McKinnon), was used to perform further analysis. Cronbach alpha coefficient of 0.61 was calculated to assess the reliability of variables, Table 4.5 in Appendix B. It is considered that the Cronbach alpha is positively influenced by the number of indicators (Peterson, 1994, p. 384), and the conclusion is made that the instrument is reliable. The above test results were considered to be sufficient to perform mediation analysis and the statistical model is diagrammed in Figure 4.1, accordingly.

Figure 4.1: Simple mediation model for skills application influence in the form of a statistical diagram.



Source: (own illustration)

The regression coefficients are: a = 0.2748, b = 0.2506, and c' = 0.2487. In the form of two OLS regression models, they can be summarized as follows, Eq. 4.1 and Eq. 4.2:

$$\widehat{M} = 0.9203 + 0.275X \quad (4.1)$$

$$\widehat{Y} = 1.2438 + 0.2487X + 0.2506M \quad (4.2)$$

Regression coefficient *a* shows that employees who participate in learning are, on average, 0.275 units higher in their skills application. It is statistically significant, $p < 0.001$ with 95% confidence interval (CI) between 0.2458 and 0.3038. Regression coefficient *b* for skills application reveals that employees who have enjoyed the same learning but differ in their skills application are estimated to differ by 0.2506 units on operational excellence, $p < 0.001$, with 95% CI between 0.2060 and 0.2952. Regression coefficient *c´* suggests that employees who differ by one unit on learning but are equal on skills application are estimated to differ by 0.2487 units on operational excellence, $p < 0.001$, with 95% CI between 0.2161 and 0.2813.

The indirect effect of learning on operational excellence was tested using a percentile bootstrap estimation approach with 10,000 samples, executed with the PROCESS macro (Hayes, 2018). The results indicate the indirect coefficient of $ab = 0.2748(0.2506) = 0.069$. This indirect effect is statistically significant, as revealed by a 95% bootstrap upper and lower level CI that is entirely above zero ("BootLLCI" = 0.056 to "BootULCI" = 0.082). Employees who differ by one unit in their learning are estimated to differ by 0.069 units in their operational excellence as a result of the effect of learning on skills application which, in turn, affects operational excellence. Thus, a mediation effect of skills application in the relationship between learning and operational excellence was established and it can account for 0.069 of total effect. Despite the statistical significance of the effect, it is small. The direct effect of learning on operational excellence, $c´ = 0.2487$. The explanation of the direct effect is given above. The total effect of learning on operational excellence effect reveals how much two employees who differ by one unit on learning are estimated to differ by 0.3437 on operational excellence: $c = c' + ab = 0.2487 + 0.2748(0.2506) = 0.3176$. It is statistically significant, $p < 0.001$ with 95% CI between 0.2876 and 0.3475.

The analysis results in Figure 4.2 of Appendix B reveal that learning and skills application are significant predictors of operational excellence. Learning was found to be the most influential at explaining operational excellence as compared to skills application. The causal steps approach provides significant evidence of mediation. The total effect is stronger than the direct effect. The mediation model explains 17% of the variation in the response variable around its mean ($R^2 = 0.1673$). Therefore, all three hypotheses hold and cannot be rejected.

Conclusion

Obviously, people are different in their skills application abilities. The differences are related to environmental factors and also to the accumulation of human capital. When companies hire new employees, they do not necessarily possess all required skills to fulfill the job requirements. Consequently, the need to learn and to accumulate human capital during the entire job life is a fundamental necessity in the workplace and the focus of this research.

This paper provides empirical evidence on the mediation effect of skills application in the relationship between learning and operational excellence using data from an operational unit of a knowledge-intensive company. Furthermore, it gives an overview of the available theoretical basis for learning, skills application and operational excellence and summarizes what has been empirically proven on learning effects so far.

Results indicated that learning is a significant predictor of skills application, and that skills application is a significant predictor of operational excellence. Receiving learning in the workplace is associated with approximately 0.069 points higher operational excellence as mediated by skills application. In summary, all three hypotheses were supported by the empirical analysis. The predictive power of the specified mediation model is 17%. This can be considered as well specified, because the survey was based on subjective ranking by people and people are harder to predict. However, it is also an indication for further research that besides learning and skills application, there are other factors which impact operational excellence. The specified model is a simple one and may be extended by further variables such as knowledge, job satisfaction, etc. It would also be interesting to test the model by using structural equation modelling and to specify dimensions of operational excellence more precisely.

This research work has a high practical relevance for operational companies in increasing operational excellence, setting up the right learning environment and encouraging skills application. The results showed that training should not be considered as an independent event, but that it needs to be connected with skills application. Both, an effective learning environment and relevant skills application, are crucial to achieving better operational excellence.

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Appendix A. Analyzed empirical studies on training effects from 1972 till 2018

Authors	Country	Independent variable	Dependent variable 1	Dependent variable 2	Effect on dependent variable 1	Effect on dependent variable 2
(Hand & Slocum, 1972)	US	Managerial human relations training	Knowledge	Attitude, behavior	No effect	No effect
(Holoviak, 1982)	US	Company-sponsored training	Company productivity		+	
(Russell, Terborg, & Powers, 1985)	US	Retail sales training	Organizational support	Performance	No effect	+
(Greenhalgh & Stewart, 1987)	UK	Vocational training	Occupational status of women	Occupational status of men	+	+
(Bartel, 1989)	US	Formal training	Labor productivity		+	
(Schneider & Colan, 1992)	US	Supervisor specific training	Supervisor specific knowledge		+	
(McLinden, Davis, & Sheriff, 1993)	US	Training	Competence in tax area		+	
(Bishop, 1994)	US	Formal off-the-job training	Employee productivity		+	
(Bartel, 1995)	US	On-the-job training	Wage growth	Job performance	+	+

(Black & Lynch, 1996)	US	Formal off-the-job training	Productivity in production companies	Productivity in non-production companies	+	+
(Barling, Weber, & Kelloway, 1996)	CA	Transformational leadership training	Attitudinal outcomes	Financial outcomes	+	+
(Dearden et al., 1997)	UK	Employer-provided training	Job mobility		-	
(Krueger & Rouse, 1998)	US	Participation in training	Turnover		No effect	
a. (Barrett & O'Connell, 1999)	IE	General training	Productivity growth		+	
b. (Barrett & O'Connell, 1999)	IE	Specific training	Productivity growth		No effect	
(Dearden, Van Reenen, & Reed, 2000)	UK	Private sector training	Productivity		+	
(Zweimüller & Winter-Ebmer, 2000)	CH	Firm-specific training	Employee turnover		-	
(Jansen et al., 2000)	NL	Training	Knowledge test		+	
(Jones, 2001)	GN	Firm-provided training	Productivity		+	
(de Kok, 2002)	NL	Firm-provided training	Production		No effect	
(Cooney, Terziovski, & Samson, 2002)	AU, NZ	Training	Employee moral	Company effectiveness	+	+

a. (Zwick, 2002)	DE	On-the-job training	Firm productivity		-	
b. (Zwick, 2002)	DE	External training	Firm productivity		+	
(Towler, 2003)	US	Charismatic influence training	Declarative knowledge	Charismatic behaviors	+	+
(Liu & Batt, 2005)	US	On-the-job training	Employee performance		+	
(Dearden, Reed, & Reenen, 2005)	UK	Training	Productivity		+	
(Úbeda-García, 2005)	SP	Training policies	Performance		+	
(Bell & Grushecky, 2006)	US	Safety training program	Effectiveness in reducing injuries		No effect	
(Lowe et al., 2007)	UK	Training	Knowledge	Attitude	+	+
(Kuckulenz, 2006)	DE	Training	Wage	Productivity	+	+
(Tan, Savchenko, Gimpelson, Kapeliushnikov, & Lukiyanova, 2007)	RU	In-service training	Firm productivity	Firm performance	+	+
(Jones, 2008)	UK	Training	Job satisfication	Workplace performance	+	No evidence
(Colombo & Stanca, 2008)	IT	Training	Labor productivity		+	
(Chauvin, Clostermann, & Hoc, 2009)	FR	Decision-making training	Capability	Performance	+	No effect

(Konings & Vanormelingen, 2010)	BE	Firm training	Productivity	Wage	+	+
(Hinerasky & Fahr, 2011)	DE	E-Learning training	Performance		No effect	
(Pfeifer, Janssen, Yang, & Backes-Gellner, 2011)	DE	Employer-provided formal training	Employee suggestions	Promotions	Short term but +	+
(Khan, Khan, & Khan, 2011)	PK	Training and development	Organizational performance		+	
(Magableh, Kharabsheh, & Al-Zubi, 2011)	JO	Training	Firm performance		+	
(Ng & Dastmalchian, 2011)	CA	Training	Probability to put skills into practice		+	
(Lee, 2012)	ZA	Training	Customer service		+	
(Wang & Wang, 2012)	CN	Tacit knowledge sharing	Operational performance	Innovation quality	+	+
(Jones, Kalmi, & Kauhanen, 2012)	FI	Training (general & firm-specific)	Wages	Organizational performance	+	No effect
(Sultana, Irum, Ahmed, & Mehmood, 2012)	PK	Employer-provided training	Employee performance		+	
(Sunardi, Widyarini, & Tjakraatmadja, 2012)	ID	Training	Employee behavior		+	

(Birdi, Leach, & Magadley, 2012)	UK	Creativity training	Creative problem-solving skills	Motivation to innovate	Short term but +	Short term but +
(Neirotti & Paolucci, 2013)	IT	Training	Acquisition of new knowledge	Organizational learning	+	No effect
(Percival, Cozzarin, & Formaneck, 2013)	CA	Training	Productivity		Partially +	
(Fu et al., 2013)	CN	Training	Behavior	Sales performance	+	+
(Chien, 2013)	TW	Intellectual capital accumulation	Organizational performance		+	
(Rowell, Binkley, Thompson, Burris, & Alvarado, 2013)	US	Food safety training	Knowledge of food safety practices		No effect	
(Sung & Choi, 2014)	KR	Training and development	Organizational innovation		+	
(Ombayo, Egessa, & Shiamwama, 2014)	KE	Career training	Employee productivity		+	
(Kim & Ployhart, 2014)	KR	Internal training	Firm profit growth		+	
(Marin-Diaz et al., 2014)	SP	Training	Financial turnover		+	
(Dostie & Léger, 2014)	CA	Firm-sponsored training	Production	Wage	Falling but +	Falling but +

(Kolibáčová, 2014)	CZ	Employee competencies	Employee performance		+	
(Dostie, 2014)	CA	Training	Process and product innovation	Firm-level productivity	+	+
(Huang, 2015)	US	Business training	Financial performance		+	
(Al-Mzary, Hani, Al-rifai, & Al-Momany, 2015)	MY	Training	Employee performance		+	
(Waris, 2015)	ID	Training, competence, etc.	Employee performance		+	
(Odhon'g & Omolo, 2015)	KE	Training, skills development, etc.	Organizational performance		+	
(Sembiring, 2016)	ID	Knowledge & skills	Firm performance		+	
(Guerrazzi, 2016)	IT	Employer-financed training	Firm productivity		+	
(Anitha & Kumar, 2016)	ID	Training	Employee productivity		+	
(Groh, Krishnan, McKenzie, & Vishwanath, 2016)	JO	Soft skills training	Employment outcomes of young women		No effect	
(Tetteh, Sheng, Yong, Narh, & Sackitey, 2017)	GH	Training and development	Employee performance		+	
(Demiral, 2017)	TR	Training	Job satisfication		+	

			and achievement			
(Suharno & Despinur, 2017)	ID	Competence	Work performance		No effect	
(Yang et al., 2017)	TW	Training	Task performance		+	
(Afroz, 2018)	BD	Training (motivation, etc.)	Employee performance		+	
(Sendawula et al., 2018)	UG	Training	Employee performance		+	
(Kurtmollaiev, Pedersen, Fjuk, & Kvale, 2018)	DK, NO, SE	Design thinking training	Sensing and seizing capabilities	Operational capabilities	+	-
(Mensmann et al., 2018)	TG	Personal initiative training	Female business success		+	
(Sanyal & Hisam, 2018)	OM	Training and development	Employee performance		+	
(Shen & Tang, 2018)	CN	Training	Customer service quality		+	

Appendix B. Mediation analysis using regression-based tests and bootstrapping performed in IBM SPSS Statistics 25

Table 4.1: Statistics: Missing values, extremes

	N	Mean	Std. Deviation	Missing		No. of Extremes[a]	
				Count	Percent	Low	High
Skills application	3714	1,58	,908	16	,4	0	255
Operational excellence	3707	2,23	1,084	23	,6	0	0
Learning	3715	2,38	1,224	15	,4	0	0

Table 4.2: Case processing summary

	Cases Included		Cases Excluded		Cases Total	
	N	Percent	N	Percent	N	Percent
Skills application	3686	98,8%	44	1,2%	3730	100,0%
Operational excellence	3686	98,8%	44	1,2%	3730	100,0%
Learning	3686	98,8%	44	1,2%	3730	100,0%

Table 4.3: Descriptives: Skewness and kurtosis

		Skills application	Learning	Operational excellence
N	Valid	3686	3686	3686
Skewness		1,907	,652	,723
Std. Error of Skewness		,040	,040	,040
Kurtosis		3,426	-,685	-,182
Std. Error of Kurtosis		,081	,081	,081

Table 4.4: Breusch-Pagan test for heteroskedasticity [a,b,c]

Chi-Square	df	Sig.
54,012	1	,000

a. Dependent variable: Operational excellence

b. Tests the null hypothesis that the variance of the errors does not depend on the values of the independent variables.

c. Predicted values from design: Intercept + Skills application + Learning

Table 4.5: Reliability statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
,610	,616	3

Figure 4.2: Output from the PROCESS procedure for SPSS Version 3.2.01 for the simple mediation analysis on how learning transmits its effect on operational excellence through skills application

```
Model : 4
  Y : Operational excellence
  X : Learning
  M : Skills application
  Sample Size: 3686

**************************************************************************
  OUTCOME VARIABLE:
  Skills application
  Model Summary
  R         R-sq      MSE    F(HC3)      df1        df2            p
  ,3702     ,1371     ,7132    344,5058    1,0000   3684,0000      ,0000

  Model
              coeff     se(HC3)     t           p        LLCI     ULCI
  constant    ,9203     ,0299       30,7838     ,0000    ,8617    ,9789
  Learning    ,2748     ,0148       18,5609     ,0000    ,2458    ,3038

**************************************************************************
  OUTCOME VARIABLE:
  Operational excellence
  Model Summary
  R         R-sq      MSE    F(HC3)      df1        df2            p
  ,4090     ,1673     ,9764    300,1530    2,0000   3683,0000      ,0000
  Model
              coeff     se(HC3)     t           p        LLCI     ULCI
  constant    1,2438    ,0406       30,6119     ,0000    1,1641   1,3234
  Learning    ,2487     ,0166       14,9646     ,0000    ,2161    ,2813
  Skillsap    ,2506     ,0227       11,0222     ,0000    ,2060    ,2952
**************************** TOTAL EFFECT MODEL ****************************
  OUTCOME VARIABLE:
  Operational excellence
  Model Summary
  R         R-sq      MSE    F(HC3)      df1        df2            p
  ,3592     ,1291    1,0210   431,7219    1,0000   3684,0000      ,0000

  Model
              coeff     se(HC3)     t           p        LLCI     ULCI
  constant    1,4744    ,0374       39,4717     ,0000    1,4012   1,5477
  Learning    ,3176     ,0153       20,7779     ,0000    ,2876    ,3475

*************** TOTAL, DIRECT, AND INDIRECT EFFECTS OF X ON Y ***************
  Total effect of X on Y
              Effect    se(HC3)     t           p        LLCI     ULCI
              ,3176     ,0153       20,7779     ,0000    ,2876    ,3475
  Direct effect of X on Y
              Effect    se(HC3)     t           p        LLCI     ULCI
              ,2487     ,0166       14,9646     ,0000    ,2161    ,2813
  Indirect effect(s) of X on Y:
             Effect    BootSE   BootLLCI   BootULCI
  Skillsap   ,0689     ,0067     ,0560      ,0820

************************ ANALYSIS NOTES AND ERRORS ************************
  Level of confidence for all confidence intervals in output: 95,0000

  Number of bootstrap samples for percentile bootstrap confidence intervals: 10000

  NOTE: A heteroscedasticity consistent standard error and covariance matrix estimator was used.

  ------ END MATRIX -----
```