

The Learning Potential of the Workplace

Wim J. Nijhof

and

Loek F.M. Nieuwenhuis (Eds.)



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Wim J. Nijhof

University of Texas at Tyler, USA

Loek F.M. Nieuwenhuis

University of Twente, The Netherlands



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In 2001, on the market in Goettingen, Germany, within the inspiring context of a large symposium of the COST A11 action on flexibility, mobility and transferability in vocational education and training in Europe, a Dutch research programme on the learning potential of the workplace was created. The two editors, together with Robert Jan Simons (University of Utrecht), tasted a marvellous Italian espresso and designed in the open air a competitive proposal for four PhD projects and an integrative project on learning in work based contexts. We used competing approaches for investigating work based learning in order to cover the complexity of the merging field between two major societal systems: the world of work and the world of education. The European research community, assembled in the COST activity A11 on Vocational Education formed the fundament for an international expert group, that supported the research fellows in the Dutch research programme. Two international expert seminars have taken place in resp. 2003 and 2005 on the campus of The University of Twente in the Netherlands. The volume we are presenting here, is one of the results of these meetings and inspiring discussions.

The research programme “The Learning Potential of the Workplace”(2002-2006) was granted by the Dutch Science Foundation (NWO- Research Grant 411-21-306). The focus of the programme is if organised conditions, work processes and personal factors will lead to effective learning and performance at the workplace. There is no simple answer to this question, neither is there a simple strategy to solve the problem. Workplace learning seems to be seen as the only solution to solve the problem of skill formation and competence development, to bridge skills gaps and to match with labour market demands. From the perspective of the knowledge society, there are high expectations regarding sharing knowledge between workers in communities of practice, even through all kinds of informal learning.

In our research programme we set the task to analyse, describe and explain the conditions of the workplace as a tool for learning. Learning potential is for some experts an individual asset, others see the learning potential in the external conditions in work and work processes; again others see it in the reflection on action by peers, colleagues and experts. Some results are disappointing when the belief is that workplace learning might be the panacea for all life long learning problems; some results are hopeful for those who believe that the workplace is one of the potential places where people can learn specific competencies.

The selection of chapters in this volume represent different opinions, visions and methodology to study workplace learning and the effects. The focus is on vocational education and human resource development, so workplace learning as a means to socialize youngsters in work organisations on their way to professionals and workplace learning as means to work, to innovate, to do maintenance work, and to create knowledge.

We thank all the authors for their efforts to bring forward the best knowledge they have regarding workplace learning and to cooperate with us.

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We thank Gay Howells for her energy and native language talent to help us to realize a consistent and readable book.

Workplace learning is not an easy subject to study. We have tried to analyze the topic in depth, to see where the learning potential might be. We hope that this book offers insights and opportunities for further study, analysis, and discussions.

Wim J. Nijhof & Loek Nieuwenhuis
Enschede, October, 2007

Part 1: What is learning potential?

WIM J. NIJHOF & LOEK F.M. NIEUWENHUIS

CHAPTER 1

The learning potential of the workplace

1.1. Learning in context: key to work

Since the 1980s, the focus on learning environments has changed considerably in educational research. In earlier decades, most efforts were concentrated on optimisation of the classroom system by improving instructional technology and instructional and training systems (Romiszowski, 1988). Optimisation of learning time, the search for effectiveness in terms of group size, instruction techniques and pedagogy, teaching and coaching behaviour, mixed ability grouping, etc. were used to find the best place to learn.

Another approach was to focus on powerful learning environments, integrating instructional psychology, instructional technology and instructional design, mostly based on or connected to constructive learning theories (DeCorte, Verschaffel, Entwistle & Van Merriënboer, 2007). In these theories, the construction of knowledge by learners became important and the focus changed from instruction to learning in context, where the principle of decontextualisation could lead to a better understanding of the world. Finding basic knowledge and principles would help to transfer knowledge to other or similar situations. The power of powerful learning situations is the empirical proof that such a kind of learning would better help to solve problems, both individually and in a team effort, than any other learning environment.

The principle of learning in context is a principle that anthropologists have used all the time; the work of Bateson (1972) for instance, as well as that of Lave & Wenger (1991) and Wenger (1998) contains indications for learning in context as meaningful action. The school as a place to learn, and especially the classroom as a place for meaningful learning, has been criticised for many years (Engeström, 1991; Illich, 1972). Compared to other institutions like the family, sports, the church and organised work, learning in school seems to have become disconnected from the real world. Schools, which should reflect the real world, have, however, become more and more focused on the transmission of principles that should be transferred to other problems and issues, albeit without great success. Learning in and out of school (Resnick, 1987) has become an important issue to open the windows of learning.

Vocational education and especially vocational schools have the advantage of being connected to the world of work. These schools were constructed in the middle of the 19th century as an answer to improper, unsafe or inefficient training methods at the workplace. The basic idea was that the training of the future

workforce would be more effective and efficient in special schools and training centres (Cremin, 1961). It was work that became a constituent part of schools, not only vocational schools; organised work became a major part of people's lives (Dewey, 1900; Kerschesteiner, 1930; Kilpatrick, 1918). Preparing youngsters for the future means preparing them for a working life, through, for example, internships and apprenticeships. The best place for preparation for work seemed to be the training centre or school, where the basic principles of construction work and the necessary skills could be learned in a standardised way in combination with workplaces: the dual system.

This was the time of the pre-industrialised society, in which physical skills were very important. Different societies and countries tried to set up manpower programmes to build a workforce for economic progress. Vocational schools were and still are connected to firms and later became part of the schooling system, with many variations within and between countries (Stoeger, 2007). Learning was seen as a preparatory stage for work and working life.

With the advent of the 21st century and the great ideas about information and knowledge societies, together with the growing impact of information technologies, the key idea of work is shifting towards knowledge-intensive work and is focused on knowledge production (Machlup, 1980). Although not all work will be knowledge-intensive and not all expectations will lead to high skilled workplaces (Brown, Lauder & Green, 2001), the conditions for future work and workers are labelled flexibility, transferability and mobility (Achtenhagen, Nijhof & Raffe, 1995; Nijhof, Heikkinen & Nieuwenhuis, 2002). These three key terms focus on a very strong cognitive orientation and on learning processes at work.

Learning is becoming a constituent part of work. Anthropologists would smile, because it is their main belief that lifelong learning in context is the essence of mankind, and therefore an integral part of what people do, including work.

Educationalists and instructional technologists, however, have built educational and vocational systems based on pedagogical, educational, sociological, economic and macro-political principles. The function of learning has to a great extent been taken from the church, the family and social institutions and brought into schools; training and education for vocations and professions have been integrated into colleges. Institutional thinking and macro-political factors have led to instructional systems based on individual development, career development, citizenship, vocational education, and instrumental lifelong learning goals like learning to learn. Skill formation has become an important strategy in lifelong learning strategies, for instance in Europe (Nijhof, 2005), where it is connected with the rethinking of the concept of competence and performance, and with a new look at the workplace as a place for learning.

The concept of skill formation in Europe in a vertical system and connected to different branches and sectors has led to qualification systems with different goals at the individual, social and macro level of society, even at European level.

This means that goals like socialisation in a profession, transferability (as a cognitive acquisition principle) and mobility (in the European labour market and in the VET system itself) are important, as are flexibility in jobs and careers, and in

different pathways or curricula. As a consequence of these macro-developments, generic vocational competences or key qualifications have been promoted in the USA and in many European countries (Nijhof & Streumer, 1998; Nijhof & Brandsma, 1999; Nijhof, Heikkinen & Nieuwenhuis, 2002; Toolsema, 2003). The statement by Billett (2003) that such measures seem to be neither effective nor realistic, while these competences have to be embedded in a particular context, has been refuted by studies by, for example, Shavit and Muller (1998). They show that European qualification models are very effective in organising labour market destinations and income.

Heijke & Ramaekers (1998) and Van der Velden (2006) indicate that, for instance, economists need generic and discipline-specific competencies. Billet is mixing up pedagogy (how and where to learn competencies) with the logic and justification of qualification systems and performance thinking at the macro-level. Learning competencies at work is just one example to show that important cognitive competencies are not always acquired. Bailey, Hughes and Moore (2004) demonstrate that academic skills are not achieved at the workplace.

This raises the question of job-specific training related to performance (in embedded contexts: the workplace) and vocational education (in schools, as well as in organised workplaces [for internships and apprenticeships]).

If we take the goals of the system in relationship to the institution, we obtain Table 1.1.

Table 1.1. Functions of schooling related to workplace learning and school systems

Functions	VET schools (Generic)	Workplace (job specific)
Socialisation		X
Innovation		X
Maintenance		X
(cognitive) Acquisition	X	
Skills acquisition	X	X
Personal development	X	
Career development		X
Lifelong learning	X	X
Vocational education	X	
Job performance		X

The learning potential of the workplace should be proved by evidence that students and employees learn something that changes their behaviour with durable results - cognitive, affective, technical and social. While the workplace is a place to work and to perform, learning is an intermediate condition, and the learning potential of the workplace therefore lies in its conditions to support or stimulate learning. In many studies in this volume we will see how difficult it is to organise this support, to perceive opportunities for learning, to test the effects of affordances and

expansive learning, and to analyse work processes and routines as facilitators of innovation.

Of course, many tools are available: cultures, organisational settings, technical conditions and affordances, in addition to work processes, all of which might stimulate or hinder different kinds of learning processes. The workplace by itself is not an effective or efficient learning environment, neither will tacit knowledge be exchanged in a simple way or lead to significantly better learning outcomes than in school learning. Global statements about informal learning and knowledge acquisition in a range of 80 to 90 per cent (Marsick & Watkins, 1990) have never been tested or proved. This volume tries to correct misconceptions, to show different perspectives on workplace learning, and argues that we need more empirical research to test these prophecies and assumptions. As we do so, the knowledge coming from this type of research will help to improve the workplace as a learning place. The need for evidence is there.

1.2. Two perspectives

The research theme 'working and learning' can be approached from two major perspectives. The first deals with the organisation of labour, from which arise issues such as work as a creative process, in which expertise has to be used to perform optimally, but also issues like the efficient use of resources in order to transform automation and the benefits of scale in increasing competitiveness. Within this perspective, topics are studied that come under Human Resource Development (HRD) and Human Resource Management (HRM) and the design of work processes. In this perspective, learning is seen as an adaptation to the demands of work processes and as preparation for future developments in technology and the global economy.

The second perspective on research into working and learning is concerned with the development of skills, competencies and craftsmanship by youngsters (and sometimes by older workers and the unemployed). In much educational research on vocational and professional training, it is assumed that, for the development of expertise, the experience of real work situations cannot be omitted. Skilling trajectories consist of a sophisticated equilibrium between work-based training and school-based education. This second perspective is the field of vocational pedagogy and instructional science.

These two perspectives merge when studying vocational and professional career development: from novice, via apprentice, to craftsman and expert status from a perspective of lifelong learning. Vocational and professional education and training nowadays deals with the first part of this career, whereas corporate training strategies are concerned with the later stages. Studying the learning potential of the workplace is relevant from both perspectives.

The question is whether the workplace is designed for learning. For Garrick (1998) and Ellström (2002), the workplace is a production environment (where the logic of production is dominant), not a learning environment (where the logic of learning is essential). Efficient and effective learning impose requirements on

workplaces that are different from those for efficient and effective working, as many studies on apprenticeship and learning bays show. Even if a production organisation is developing into a learning organisation, many problems appear regarding the conditions and/or affordances for learning possibilities. Work experience as such does not automatically lead to profound expertise. On the other hand, school-based trajectories are not good learning environments for all kinds of competencies either (Resnick, 1987), or at least for specific target groups. Thus the learning potential of the workplace is not an absolute dimension, but depends on many internal and external processes.

Studying the learning potential of the workplace is investigating the interaction of conditions to promote learning at work. The learning potential of the workplace may therefore be defined as the power of a work setting to integrate learning at work with the result of behavioural changes and the generation of new knowledge. Such a workplace offers accessible information, opportunities to learn and real support by peers and managers.

Many of the chapters in this volume focus on these aspects and affordances for learning.

Many questions arise about learning and working, as opposing processes in terms of performance versus prerequisites, or in terms of risks and safety, and routines versus adventure, mistakes and innovation. Does learning at the workplace lead to cognitive and meta-cognitive skills? Does it lead to mobility between jobs or to just-in-time, just-enough skills for the job? The movement from school systems to workplace learning is worldwide, risky and based on the assumption that the workplace is the only and the best place to adapt to the dynamics of our time. We need to understand what the workplace can do in facilitating specific learning processes and developing competencies (Nijhof, 2006).

In a knowledge-based economy, working and learning are connected processes. As De Wilde (2001) states, human activity has always been knowledge-based, from ancient times up until the 21st century. This could lead to the thesis that humans are always learning while performing productive activities. In our view, that is a too optimistic and romantic view: several conditions make learning at the workplace less obvious. Human work is design-based: Taylor's approach to the scientific rationalisation of industrial labour was targeted at excluding learning on the shop floor. By rationally designing labour, the greatest efficiency would be reached by organising learning and thinking at the front end of working processes: industrial engineering bans learning at the workplace in favour of efficiency and avoiding mistakes. The rationalisation of labour has received much criticism from more humanistic approaches to work, in which the autonomous worker occupies the foreground (for example, socio-technical approaches). The quality of labour and the learning potential of the workplace depend on internal labour politics and company strategies towards economies of scale. Workplace learning is contested through all kinds of negotiating processes within communities of practice and between workers and management.

Vocational education and training too are a matter of human design: educational practice and science both deliver insights serving as input for the design of learning

trajectories towards the efficient and effective support of trainees in becoming skilled and competent. The balance between working and learning can be seen from this perspective.

What is the most effective route to enable novices to conquer the mysteries of vocations and professions? The learning potential of the workplace plays an important role in this argument. What is the learning output of work activities and how efficient is the learning process in terms of economic and educational goals, compared to other training trajectories (for example school-based training or simulated practice)? In our view, the learning potential of the workplace is a relational concept: its learning potential depends both on the characteristics of work and the organisation of work, as well as on the individual commitment and expertise of the trainee. Novices will learn differently with different outcomes from experts in comparable working-learning environments. Affordances of the workplace could be exploited differently for skilling objectives by different workers and collectives of workers. Many of the studies presented in this volume show that the task is not easy and the outcomes not always stimulating. It might help to realise that the workplace is not a panacea, but just one of the learning environments in which to become competent.

1.3. Introducing this volume

For this reason, the learning potential of the workplace as a research topic refers strongly to the design and use of learning and work processes. Designers, participants and supervisors all have their impact on the input, processes and output of work and learning at the workplace. This makes it a complex and interesting field of research, which can be approached from many theoretical fields. In this volume, we aim to present an overview of these approaches. In order to avoid kaleidoscopic chaos, we have organised the volume into five parts.

Part 1, about the **Learning potential of the workplace**, gives an overview of disciplinary perspectives on learning at the workplace: the economic, organisational, cultural, activity theory and psychological aspects of workplace learning are presented in four different chapters.

Andries de Grip takes the lead with Chapter 2 on the economic perspectives of workplace learning. Starting with human capital theory, and a cost-benefit analysis of different skilling trajectories, he finishes with perspectives on high-performance workplaces, in which learning plays an important and necessary role. From a macro-analysis of the role of human capital, economics is focusing more and more on opening the black box of workplace learning.

In Chapter 3, David Ashton focuses on organisational factors generating workplace learning cultures. In his view, organisational factors are not simply background features to individual learning processes, but essential factors to understand workplace learning processes. Understanding organisational factors can support effective policy interventions in order to evolve from restrictive learning to expansive learning in work environments.

Susanne Weber in Chapter 4 elaborates on the cultural aspects of workplace learning. Intercultural learning and identity negotiation are central to her work. The intercultural frame can support the effective design of training curricula and workplace practices.

Finally, in Chapter 5, Dave Bartram and Robert Roe take a psychological perspective on competence acquisition in present-day organisations. They show the impact of individual and organisational factors on the learning of competencies. General mental ability, combined with personality characteristics, interacts with organisational factors like opportunities to learn, feedback and learning climate.

Part 2 focuses on **learning processes at the workplace**. It concerns micro-approaches to workplace learning, from the perspective of both the design of labour and the design of learning.

Stephen Billett, together with Michelle Barker and Ray Smith, focuses in Chapter 6 on dualities in both the process and outcomes of participation in work. The social and the individual are interdependent, both in the process of participation and learning and in the outcomes of learning. The goals and intentionalities of individuals are intertwined with their work and working lives.

David Thornton Moore, drawing on extensive research within US cooperative education, in Chapter 7 addresses the question of how power and status relations in workplace settings impact on the learning of students. The organisation of work processes, organisational culture and external factors such as market forces and regulations shape the micropolitics of knowledge acquisition in work settings.

In Chapter 8, Lorna Unwin and colleagues focus on the relation between context and pedagogy in the workplace in a multi-sector study. The external and internal context is essential to understand the nature of pedagogical practice in workplace settings. This chapter tries to unlock the mystery of why organisations adopt different learning-working practices.

In Chapter 9, Cindy Poortman and Wim Nijhof present the results of a project on the learning processes in caring of VET students. Based on Illeris' theory of learning, the workplace learning processes of students in courses for elderly care are described in detail. Entering the workplace, students lose contact with their school environment, which leads to learning and reflection from a very narrow work-task perspective. The learning potential lies in the opportunity for performance improvement, rather than in the application of theory to practice.

Central to part 3 is **the interaction between individual and organisational aspects** of work and learning. At the core of this part is the impact of interaction processes on workplace learning.

In Chapter 10, Franck Blokhuis and Wim Nijhof present the results of an intervention study to optimise the guidance and coaching of VET students at the workplace. The results show that guidance and coaching instructions for workplace supervisors are only partly implemented, because of organisationally restrictive conditions. Novice supervisors benefit from the instructions, as shown by user data. However, competence development was not easy to detect.

In Chapter 11, Derk-Jan Nijman and colleagues present a study on managerial support for the transfer of training at the workplace. Managerial support has a

substantive impact on the quality of company training and the transfer of learning outcomes to practice.

Patrick Meling and Regina Mulder present a study on motivational conditions in Chapter 12. Three theoretical models of motivation (flow theory, cognitive motivation model and self-determination theory) are investigated through the evaluation of a web-based professional training. From these data, the self-determination theory especially turns out to be a good predictor of learning motivation.

In Chapter 13, Heinz Mandl and Oliver Bürg present a study on the acceptance of e-learning in companies. E-learning is increasingly used in company training, but is encountering a low level of employee acceptance. In the study, three clusters of relevant variables are discerned: institutional, individual and learning environment variables. All three clusters impact on attitudinal acceptance, which, in turn, has an impact on the behavioural acceptance of e-learning in company training settings.

Part 4 focuses on the organisational level. **Organisational learning and learning in organisations** is discussed in this part.

In Chapter 14, Nick Boreham focuses on a strategy for improving corporate performance, in which organisational learning plays a major role. In a case study of a large oil refinery plant, an organisational enquiry by employees is used to improve shop floor and plant performance. Organisational enquiries turn out to be a form of structuration: both organisation and individual behaviour are reconstituted by this activity.

Marianne van Woerkom in Chapter 15 shows that reflective learning at the workplace depends both on individual characteristics (self-efficacy) and on organisational variables. The way organisations create participation possibilities for their employees especially proves to be predictive of reflection at work.

Jan Waalkens, René Jorna and Theo Postma present in Chapter 16 a theory about the absorptive capacity of engineering SMEs. Absorptive capacity is defined as the dynamic capability of learning from the external network through a repertoire of problem-solving routines and search behaviour. Both internal and external behaviour is relevant to improving the absorptive capacity of the firm: linking internal processes and external networking.

In Chapter 17, Aimée Hoeve and Loek Nieuwenhuis concentrate on the relation between the innovative strategies of the firm and learning activities on the shop floor. The concept of collective routines is crucial to understanding the intersection between the individual and the team and between the team and the organisation. The chapter also deals with methodological issues of how to investigate routines in actual work environments.

Finally, part 5 contains **reflections** on the outcomes of this international volume and the research programme. Avenues for future research in this field are outlined.

In Chapter 18, Loek Nieuwenhuis and Marianne van Woerkom argue that understanding work-related learning needs a set of different rationalities in relation to the institutions that are involved in workplace learning.

1.4 Concluding remarks

This volume provides an overview of international empirical research on workplace learning, both qualitative and quantitative, and on an individual, team and organisational level. The aim was to relate different scientific approaches to workplace learning in order to gain an understanding of this complex phenomenon. Through this approach, the conflict between different rationalities became apparent. Understanding workplace learning depends on both the theoretical and the practical perspective that the observer takes. Workplace learning is a practical issue with many theoretical puzzles to be solved. The appreciation of workplace learning depends on the goal rationality of the actor concerned; economic and educational values especially compete for priority. Macro and micro-perspectives also lead to different valuations and investments in workplace learning: what is beneficial from a societal perspective is not automatically beneficial from an organisational or individual perspective. Arguments for learning efficiency do not always carry weight in economic debates and vice versa.

This leads to the conclusion that a general theory of workplace learning is a Utopia to strive for. We can unfold the different interests involved, and from these we can argue for effective and efficient ways of designing workplace learning. It will always be a case of striking a balance between individual and organisational rationalities. Taking an educational perspective, training professionals have to negotiate with firms to enhance the learning potential for their apprentices and students. Training professionals have to compensate for inefficiencies caused by production goals or for skills that are lacking as a consequence of obsolescence, ageing and innovations. Taking an economic perspective, managers have to negotiate with trainers and teachers in order to enhance the firm-specific quality of course design. Both on an organisational level as well as on a strategic and political level, policymakers should be aware of this constant debate and negotiations. The different interests involved in workplace learning are not a problem to solve but a problem to live with.

This volume offers tools and insights on several levels and from different perspectives. There is no single answer as to how to enhance the learning potential of the workplace. We know for sure that not all learning claims for workplace learning are realistic; in many cases off-the-job learning proves to be more efficient and effective. However, for some target groups the workplace is the only motivational locus for learning. Hence, scientific research can reveal the pitfalls of workplace learning and can illuminate the dilemmas involved. Evidence-based research can support the design of efficient and effective workplace learning interventions, but a single recipe is now a bridge too far.

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THE LEARNING POTENTIAL OF THE WORKPLACE

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CHAPTER 2

Economic perspectives of workplace learning

IN VARIOUS FIELDS OF ECONOMIC Science the importance of workplace learning has been recognised for a long time. Human capital theory particularly focuses on the returns to “on-the-job training” and “experience”, and its relation with labour turnover. Others found that “learning by doing” is a major determinant of firm productivity, and noticed the relevance of High Performance Workplaces. More recently, labour economists are opening the black box of human capital by analysing the importance of different kinds of skills developed by formal or informal training, and studies on the determinants of the development of knowledge

2.1 Introduction

FOR ALMOST HALF A CENTURY, economic science has been analysing workplace learning, as part of the study of human capital. From an economic perspective, all activities related to learning can be seen as an investment. The idea is that individuals have to make an effort which will pay off later. The investment character of learning activities is based on the ‘human capital theory’, which was launched by a supplement to the *Journal of Political Economy* on ‘Investments in Human Beings’ in 1962. Actually, the main focus of human capital theory was on the ‘rate of return’ on the investments in the level of someone’s initial education. However, in the 1962 *Journal of Political Economy* supplement, two seminal papers by Gary Becker and Jacob Mincer had already been focusing on ‘on-the-job training’ and ‘learning from experience’:

“Graduation from some level of schooling does not signify the completion of a training process. It is usually the end of a more general and preparatory stage, and the beginning of a more specialized and often prolonged process of acquisition of occupational skill, after entry into the labour force. This second stage ranges from formally organized activities such as apprenticeships and other training programs to the informal processes of learning from experience.” (Mincer, 1962, p. 50).

Other economists derived the importance of workplace learning from their findings that firms become more productive when their workforce becomes more experienced (Arrow, 1962). Of a more recent date is the economic literature on the impact of the *High Performance Workplace*, where workers are expected to be

employed in jobs with a high learning potential, on the performance of the firm (for instance Black and Lynch, 2001).

However, in economics, the term workplace learning is often not used explicitly. Instead, economists distinguish between ‘on-the-job training’ and ‘learning by doing’. It should be noted that in human capital theory the concepts used are all related to the investment context. In this context, it is particularly important whether it is the firm or the workers who pay the costs of learning activities, and whether it is the firm or the workers who will benefit from these activities. For this reason, it is more appropriate to distinguish between *general* and *firm-specific* education and training, irrespective of whether this training takes place in the workplace or not (see Becker, 1962), and to study workplace learning activities which are an automatic by-product of productive work, i.e. learning by doing. Obviously, the latter does not necessarily mean that this learning is free, as, for instance the learning by doing of apprentices often implies that they are less productive than youngsters who do not perform any tasks which are intended to offer learning opportunities.

Moreover, it should be mentioned that in economic science it is not important whether the things someone learns refer to knowledge or skills: as both can make a worker more productive, there is no conceptual difference from an economic point of view. There is therefore no tradition of a careful use of these terms in economic science. It only seems to be more or less a matter of the personal taste of the author, without any discussion of the terminology. Some authors prefer the term ‘*knowledge*’, whereas others refer to ‘*skills*’, or ‘*competencies*’. On the other hand, the terms used are often related to the focus of a study. For instance, in the literature on the impact of technological and organisational innovations, most authors refer to computer skills, communication skills, etc., whereas in the literature on economic growth, and in the economic policy literature on the ‘knowledge economy’, most authors use the term ‘knowledge’. As this chapter refers to the economic perspectives of workplace learning, the tradition in economics will be followed: not bothering about these terminological issues and using human capital, skills, knowledge, competencies more or less as synonyms.

This chapter will discuss the economic literature on workplace learning, starting with the contributions of human capital theory, screening theory, and the literature on skill obsolescence and the High Performance Workplace. Furthermore, it considers the increasing importance of behavioural and people skills, and the way in which most firms attempt to reduce shortages in these skills among their technical workforce. Then follows an elaboration of the relation between workplace learning and labour turnover, and the complementarities of formal training and informal workplace learning. The latter section gives a presentation of some recent evidence on the relevance of informal learning for the ‘knowledge development’ of the Dutch working population.

2.2 Human Capital Theory

As mentioned in the introduction, the founding fathers of the human capital theory have already dealt with workers' learning in the workplace. We will here first discuss the contributions on economic insights about workplace learning of three of them: Garry Becker, Jacob Mincer and Sherwin Rosen.

Becker (1962) particularly focuses on the distinction between general and firm-specific on-the-job training. He defined *general training* as the training which enhances a worker's productivity in all kinds of jobs, whereas *firm-specific training* only makes a worker more productive in the firm where he or she is employed. General on-the-job training may, for instance refer to vocational skills (bricklaying, diagnoses of illnesses, etc.) that can also be applied in other firms in the same sector of the economy. Moreover, it refers to the learning of skills that can be applied across the economy such as communication skills, accuracy, etc. Firm-specific on-the-job training, on the other hand, refers to the acquisition of knowledge about machines or procedures which are only used in the firm where a worker is employed, or knowledge about specific characteristics of the products and clients of the firm.

The distinction made by Becker has two important consequences. First, only general training will increase a worker's future wage, because only the acquisition of skills that can be applied elsewhere will increase a worker's value in the labour market, whereas firm-specific skills are useless when a worker moves to another firm. Second, firms will only pay the costs of firm-specific training, because they will not benefit from investments in the general skills of their workforce, since the benefits of the higher productivity of workers who have acquired general skills are entirely reflected in higher wages. Workers therefore have to pay the costs of general training themselves. This is usually reflected in a lower wage during the period in which they are trained on the job. For this reason, workers who are employed as apprentices or trainees earn a wage which is below their productivity.

In Becker's model, it is not relevant to distinguish between formal training and more informal workplace learning, as both activities involve certain costs. These may refer to the costs of learning material or the costs of a supervisor as well as to the lower productivity of the trainee during the time he is involved in attending a course or workplace learning. In economic theory, the latter costs are known as '*opportunity costs*'.

Mincer (1962, 1974) deals with workplace learning in quite a different way: he particularly focuses on the impact of workers' experience on their productivity, as measured by their earnings. For this purpose, Mincer developed a so-called '*earnings function*', which relates workers' wages to their educational background and work experience. The log transformation of workers' incomes enables the estimated coefficients to be interpreted as the rates of return on an additional year of education or experience. Table 2.1 presents Mincer's seminal estimation results on the relation between the human capital and the annual earnings of the white male US labour force in 1959. The first equation shows that the level of a worker's initial education only explains 7 per cent of the variation in the logarithm of

income. However, when experience, as a proxy for workplace learning, is included, 28 per cent of the variation can be explained. It is interesting to see that Mincer not only included a worker's years of experience in the equation, but also the square of this number of years. The estimation results show that an additional year of experience gives the worker on average a return of 8 per cent. However, the negative coefficient of the square term shows that the rate of return levels off when workers acquire more and more years of experience. This shows that, at some point in their career, workers are virtually no longer learning anything during their work.

Table 2.1: Estimates of the relation between initial education (S) and work experience (X) and the annual earnings (y) of white men working in the United States in 1959

$\ln y = 7.58 + 0.070 S$ (43.8)	$R^2 = 0.067$
$\ln y = 6.20 + 0.107 S + 0.081 X - 0.0012 X^2$ (72.3) (75.5) (-55.8)	$R^2 = 0.285$

Source: Mincer (1974, Table 5.1)
(t -statistics in parentheses)

Actually, Rosen (1972) dealt more explicitly with workplace learning than Becker and Mincer. He particularly focused on 'the learning potential' of a job: "The fundamental hypothesis is that individuals learn from their working experience. Firms supply learning opportunities in the form of different types of work-learning activities, and to that extent engage in a kind of joint production, for learning is a by-product of market goods production" (Rosen, 1972, p. 327).

By connecting the market for learning opportunities with the market for jobs, Rosen argues that in the labour market there actually are 'package deals' in which workers simultaneously sell the services of their skills and purchase a job that offers a particular opportunity to learn. Obviously, the latter is not without cost. From the perspective of the worker, accepting a job with a high learning potential can be a good strategy to maximise their lifetime income, i.e. in their early career, workers may apply for a job with a high learning potential, as this job will be a good stepping stone for their further careers. Sicherman and Galor (1990) further developed Rosen's theoretical work in their theory on career mobility. In their model, part of the returns on initial education is in the form of higher probabilities of occupational upgrading within or across firms, due to the learning potential of their job. When workers opt for jobs with a high learning potential, their wages will be lower, but their opportunities for upward career mobility will be higher. Examples of these kinds of jobs are trainee jobs in large firms.

In the 1970s, the human capital theory was challenged by the signalling or screening theory (for instance Spence, 1973). This theory claimed that initial education does not increase a person's productivity. Instead, initial education only enables someone to signal that he or she is a high-ability worker. Thurow (1975) stated that initial education does not produce marketable skills without any job experience. Initial education merely indicates a person's *trainability*, i.e. the

training costs a firm incurs to make someone productive in the firm. This trainability not only refers to workers' cognitive learning abilities but also to their adaptability and work discipline. A higher level of initial education only helps someone to obtain a better place in the 'labour queue' for the most attractive jobs. The screening theory increases the relevance of workplace learning for the productivity of workers. Actually, it is no longer the level of initial education which makes some more productive, but only the skills learned on the job. However, just like the human capital theory, the screening theory does not distinguish between formal off-the-job training courses and workplace learning. Training is implicitly seen as a mixture of formal vocational training and informal training.

2.3 *The costs of workplace training*

Although workplace learning avoids the direct training costs and opportunity costs of formal off-the job training, it is not without costs. As mentioned above, workplace learning may include the costs of a supervisor as well as the opportunity costs due to the lower productivity of the trainee who is learning on the job. However, these opportunity costs are related to the quality or the intensity of the training. In a study of the quality of apprenticeship training in the Netherlands, Smits (2005) distinguished between firms which train apprentices because of the benefits during the training period and firms which train apprentices because of the expected benefits in the post-training period. Firms which train because of the *current benefits* from cheap trainees will offer low-quality training, because for these firms the productivity of an apprentice should be higher than the training costs. In these firms, apprentices will often do unskilled work in which they will be fully productive (Soskice, 1994). However, firms which train apprentices because of the *future benefits* will offer high-quality training, although there may be a conflict of interest between the firm and the apprentice with respect to the firm-specific or general character of the training. As Table 2.2 shows, the percentage of training firms which have a net benefit from the apprentices during the training period is rather high. Two-thirds of the training firms in the Netherlands state that they earn back the costs of employing apprentices during the training period. In business services particularly, it seems to be more difficult to gain net benefits from apprentices during the training period.

Franz and Soskice (1995) and Acemoglu and Pischke (1998) state that firms which train newly hired workers also have an important *informational advantage* with respect to the abilities and motivation of the trainees, because these firms can observe the trainees during their initial training period. Autor (2001) showed that this also holds for temporary work agencies that offer free general training to temporary workers. The information the training firms obtain about their trainees enables them only to offer a job to those trainees who have high abilities and good motivation. Obviously, this selection advantage only holds for the firms which train new hires because of the future benefits of maintaining a skilled workforce.

Table 2.2: Percentage of training firms in the Netherlands that report apprentices have net benefits during the training period.

Manufacturing	73
Garages	87
Building	65
Hotel and catering sector	76
Business services	45
Wholesale & retail trade	59
Non-profit	71
Total	66

Source: Borghans et al., 2000.

In her analysis of the quality of the apprenticeship training programmes of Dutch firms, Smits (2005) distinguished different aspects of the quality of training programmes: the complexity of production tasks, the learning content of production tasks, the time for formal learning activities at the workplace and the time for supervision and instruction. She showed that there is a considerable variation in training quality between different firms. As expected, she found that there is a relation between training quality and the training motives of a firm. Firms which recruit apprentices because of current benefits offer lower quality training than firms which have apprentices to meet their future demands for skilled workers.

2.4 Skill obsolescence

It should be noted that Mincer's estimates of the returns on experience, as a proxy for workplace learning', actually measure the net effect of workers' experience, because the knowledge workers have acquired in the past will depreciate in the course of time (Rosen, 1975). The notion of *skill obsolescence* is, of course, quite obvious from a human capital point of view. In a similar way to physical capital goods, workers' human capital will also depreciate due to technical or economic obsolescence. The first refers to the deterioration of physical or mental capacities due to ageing, the latter to the fact that the value of particular skills will decrease due to, for instance technological innovations in the production process which affect the contents of jobs (De Grip & Van Loo, 2002).

Technological innovations, however, might also give an impetus to workplace learning, because workers often learn the skills that are needed to work with a new technology in the workplace. This explains why workers who are employed in industries which are characterised by high rates of technological change are better able to retain their productivity at an older age, and have later retirement ages than workers in sectors which are less dynamic. Although the workers in these sectors of industry will face more skill obsolescence due to technological developments, the net effect of technological change on their human capital is positive, because

they continuously acquire new skills related to the new technologies (Bartel & Sicherman, 1993).

Weinberg (2002) found that the skills workers developed with respect to an obsolete technology may also be transferable to the new technology. In his analysis, Weinberg estimates the development of the returns on experience of male workers between 1959 and 1997 for both high school graduates and college graduates in the US. Whereas the returns on experience for college graduates have been flat, the returns on experience among high school graduates have increased. Remarkably, unlike the college graduates, experienced high school graduates also more often adopted new information technologies than high school graduates with less experience. This shows that, although more experienced high school graduates have greater stocks of skills which are related to the old technology, this does not prevent them adopting the new technology. This indicates that the skills that more experienced high school graduates learnt on the job with respect to the older modes of production are transferable to the new technologies. As mentioned above, Weinberg did not find similar results for college graduates. For these higher skilled workers, workplace learning with respect to older technologies does not make more experienced workers more valuable than younger graduates who more recently acquired more up-to-date skills at university.

2.5 High Performance Workplace

However, in economic science, it was not only the labour economists involved in the development of the human capital theory and the screening theory who have been analysing the role and impact of learning at the workplace. Again, at the beginning of the 1960s, Arrow (1962) emphasised the importance of unstructured workplace learning, not from the perspective of the individual worker, but from the perspective of the firm. He was involved in explaining the puzzle of why the increase in per capita income cannot be explained by increases in the capital-labour ratio. Obviously, the missing explanation for part of the economic growth is the increase in knowledge, including technological knowledge, which enables firms to optimise their production processes. Arrow argues that this increase in knowledge is acquired by learning that is the product of experience:

“Learning can only take place through the attempt to solve a problem and therefore only takes place during activity” (Arrow, 1962, p.155).

Workplace learning is therefore a more or less automatic by-product of the regular production process of a firm, which he labelled ‘*learning by doing*’. Arrow illustrated this process of learning by doing by what is known as the ‘*Horndal effect*’:

“The Horndal iron works in Sweden had no new investment (and therefore presumably no significant change in its methods of production) for a period of 15 years, yet productivity (output per man-hour) rose on average close to 2

per cent per annum. We find again steadily increasing performance which can only be imputed to learning from experience” (Arrow, 1962, p.156).

From a similar firm perspective, in the 1990s economists became more interested in the effects of the organisation of the production process. In the literature on ‘skill-based technological change’, the shifts in the skills demanded in many jobs were found to be related to the organisational changes that accompany the diffusion of ICT: flat hierarchies, autonomous work groups and teamwork (Bresnahan, Brynjolfsson & Hitt, 2002). These transformations of workplaces induced a growing demand for workers with both cognitive skills and ‘people skills’ (Autor, Katz & Krueger, 1998), while Lindbeck and Snower (2000) argued that, in addition, more flexible and ‘multi-skilled workers’ are required.

In particular, the notion of ‘*Innovative Work Practices*’ in the so-called ‘*High Performance Workplace* (HPW)’, originally developed in the discipline of Human Resource Management, has been used to explain the improved performance of a firm (for instance Ichniowski, Shaw & Prennushi (1997). Although the HPW is usually not clearly defined, many authors include (1) delegation of responsibility to autonomous teams, (2) job rotation, (3) performance-related earnings and (4) training to support organisational change, whereas some authors relate the HPW to Total Quality Management, including ‘quality circles’ (see Handel & Levine (2004) for an overview). These characteristics of the HPW form a cluster of complementary human resource practices that have a great positive effect on the productivity of the firm, while changes in individual human resource practices have little or no effect on a firm’s productivity (Ichniowski, Shaw & Prennushi, 1997).

Obviously, workplace learning is at the heart of the HPW. First, it is a necessary complement to the continuously changing and increasing demand for skills in the jobs involved. Second, offering jobs with a high learning potential will increase workers’ motivation (Zwick, 2006). Workplace learning is particularly important because of the growing demand for workers with problem-solving skills, high level communication and social skills (Dickerson & Green, 2004) and ‘multi-skilled workers’ (Lindbeck & Snower, 2000). The latter argued that the growing demand for multi-skilled workers induces a shift from ‘*intratask learning*’ to ‘*intertask learning*’:

“Intratask learning is learning by doing in the traditional sense (Arrow, 1962): the more time a worker spends at a particular task, the more skilful he becomes at performing that task and thus the greater becomes his productivity from this activity. Intertask learning, by contrast, arises when a worker can use the information and skills acquired at one task to improve his performance at other tasks” (Lindbeck & Snower, 357).

Intertask learning mainly takes place through job rotation within or between teams. It obviously includes the improvement of a worker’s ‘people skills’, and attempts to contribute to a worker’s problem-solving skills.

A recent survey among HRM managers of firms in the high-tech metal-electronics sector in the Netherlands confirmed the increasing importance of

behavioural and people skills for the *technical* employees in these firms. Seventy-three per cent of these HRM managers expect an increasing demand for more flexible workers in the next five years, 72 per cent an increasing demand for problem-solving competencies, 63 per cent an increasing demand for workers who can display initiative, and 58 per cent an increasing demand for communicative competencies (De Grip, Van Loo & Sieben, 2005).

Table 2.3: Ways in which shortages in the competencies of technical workers in the Dutch metal-electronics sector are reduced (2004) (% of firms)

Competencies	Formal course or training	Informal training	Learning by doing	No shortage
Technical knowledge and skills	55	61	23	11
Language skills	30	9	19	44
Computer/IT skills	33	26	24	22
Management skills	44	14	17	27
Teamwork skills	14	25	32	31
Problem-solving skills	8	33	32	27
Communication skills	37	20	19	24
Commercial skills	22	17	15	47
Coping with changes	12	31	33	27
Flexibility	11	27	38	27
Planning and organization skills	28	24	25	27
Creativity	4	26	28	44
Initiative	8	23	37	34
Contact with other cultures	2	10	37	52
Learning skills	6	23	32	39

Note: The percentages are not related to each other, and therefore do not add up to 100%. Source: ROA/Employers panel Metaelectro 2004

Table 2.3 shows that, apart from communicative skills, most firms attempt to reduce shortages in these skills among their technical workforce by informal training or learning by doing instead of formal training. Thirty-eight per cent of the firms try to reduce shortages in the flexibility of their workers by means of 'learning by doing', whereas only 11 per cent of the firms do this by means of formal training or a combination of the two. For improving workers' capacities to take initiative and workers' problem-solving skills, 37 per cent and 32 per cent respectively of the firms rely on learning by doing. More generally, the table shows that formal training is particularly used to reduce shortages in vocational

competencies, whereas almost all the shortages in behavioural and people skills are mainly reduced by workplace learning in the form of informal training and/or learning by doing.

2.6 Workplace learning and labour turnover

In human capital literature, the relation between workplace learning and labour turnover is also an important issue. Obviously, it is related to the question as to whether the firm or the worker can reap the benefits of the investments in workplace learning. As mentioned above, from an investment perspective there is no need to distinguish between formal and informal workplace training. However, the difference between general and firm-specific training is important here, as general skills also increase workers' productivity in other firms, whereas firm-specific skills only make a worker more productive in the firm where he or she is working. Firm-specific training will thus reduce labour turnover, whereas general training makes a worker more attractive to other firms.

In a comparative study, the OECD (1993) showed that there are very large differences in the incidence of in-house training of new hires between various countries. Whereas, in the early 1990s, the incidence of in-house training of new recruits with less than one year of tenure was almost 80 per cent in Japan, it was less than 10 per cent in the US. Blinder and Krueger (1996) attribute the low level of workplace training in the US to the high turnover of new recruits there. When firms are not certain that they can reap the benefits of investments in the training of the workforce, they will be reluctant to make these investments. Acemoglu and Pischke (1998) developed a model that emphasises the endogenous trade-off between training and labour turnover. When firms train their workers, this will reduce labour turnover, as these firms are attractive employers, whereas firms which do not invest in the training of their workers will face a high turnover. Their model shows that this trade-off can lead to multiple equilibria. Whereas in the *low training equilibrium* labour turnover is high, in the *high training equilibrium* the number of workers leaving is low. Acemoglu and Pischke show that the German apprenticeship system is a good example of the high training equilibrium. Lynch's (1993) finding that young workers who received training are less likely to leave their employer, also confirms the model of Acemoglu and Pischke.

2.7 Formal training, workplace learning and knowledge development

In the human capital literature, many studies have analysed the effects of training participation on workers' wages (see Bassanini, Booth, Brunello, De Paola & Leuven, (2005) for a recent overview). Several studies have found high returns on workers' participation in training, although the returns measured vary greatly, due to the way training is defined and measured, differences between countries and the groups analysed, and the way in which studies correct for selectivity and unobserved heterogeneity. In a study of 14 European countries, Brunello (2004) found that having recently attended training increases a worker's income by about

12 per cent. Blanchflower and Lynch (1994) found a similar result for young people in the US who participated in employer-provided training. However, Goux and Maurin (1998) found that the returns on training in France were close to zero, when they corrected for selectivity.

Moreover, it is not only the workers who benefit from workers' participation in training. Dearden, Reed and Van Reenen (2006) found that the effects of training on wages are about half that of the effects on firms' productivity. In an analysis of longitudinally-linked administrative and survey data on firms in manufacturing, trade and the building sector, Van Loo and De Grip (2003) found evidence for a mutual reinforcement of training participation and firm performance. They found that when the employees of a firm participate in one additional course this will increase the profit per employee by €12,500¹. Moreover, Van Loo and De Grip found that an increase in the profit per employee by €1,000 will cause an increase in the average training participation of 0.01 course. Although the latter effect is much smaller than the effect of training participation on a firm's profit, the mutual reinforcement between training participation and a firm's profit shows that there is a vicious circle which explains why some 'rich' firms have high training participation rates, whereas in other 'poor' firms the workforce hardly participates in training. Obviously, the results of Van Loo and De Grip (2003) show that it is attractive to firms to follow the training route.

However, one may wonder whether it is really the participation in formal training that makes the difference. When workers have to acquire additional competencies, they will learn most when they participate in a training course *and* practise the new skills in their job. Borghans, Golsteyn and De Grip (2006) found that when employers stimulate workers' participation in formal courses, these workers will also spend more time on informal learning in the workplace. However, as the above-mentioned studies of the effects of participation in formal training do not measure the time spent on workplace learning, all the benefits of the knowledge and skill acquisition of the workers will be attributed to their participation in formal training. Human capital studies which only include workers' experience as a proxy for workplace learning will overestimate the effects of formal training, because they do not include the time actually spent on informal workplace learning. So it is the complementarities between formal training and informal workplace learning which explain why participating in a course for only a few days can have such large effects on workers' earnings and firms' profits.

Borghans et al. (2006) provide detailed information on the working time Dutch workers spend on activities from which they learn on the job. On average, workers spend 31 per cent of their working time on such activities (see Table 2.4). Obviously, this is much more than the time they spend on participation in formal training. Actually, only 6 per cent of the time workers are involved in activities from which they learn refers to their participation in formal training courses; the remaining 94 per cent refers to the time they spend on informal learning activities.

Table 2.4 also shows that the time men and women spend on workplace learning hardly differs. When looking at the educational backgrounds of the workers, it is striking that particularly workers with only general secondary education less often

have opportunities for workplace learning, whereas university graduates more often perform tasks from which they can improve their competencies.

Table 2.4: Percentage of the working time that Dutch employees spend on activities from which they learn, by gender and level of education (2005)

Male	30
Female	32
Primary education	32
Preparatory vocational education	29
General secondary education	24
Intermediate vocational education	30
Higher vocational education	33
University education	35
Total	31

As might be expected, younger workers spend more time on activities which improve their competencies than do older workers. Whereas workers who are 25 years old spend almost 40 per cent of their working time on activities from which they learn, workers who are older than 50 spend less than 25 per cent of their working time on these kinds of activities. Further analyses show that the extent to which workers are involved in activities from which they learn is significantly related to organisational changes. This supports the findings of Bartel and Sicherman (1993) that workers who are employed in a dynamic workplace become more employable and less often retire early.

Borghans et al. (2006) also found that workplace learning is an important determinant of the 'knowledge development' of workers. For this analysis, they developed a measure of knowledge development by asking the respondents to give the knowledge and skills needed to fulfil their current job optimally a value of 100, and then asking them to value the competencies they had two years ago. Then, the difference between the two values indicates their knowledge development in the last two years. Table 2.5 gives an overview of the results of the analysis. As mentioned above, informal learning has a large positive effect on the knowledge development of workers. It is also interesting to see that, although participation in formal training courses also has a positive effect on workers' knowledge development, the duration of these training courses does not seem to matter. This indicates that it is particularly important that workers regularly participate in short formal training courses, as this is a stimulus for further informal learning in the workplace. Finally, the analysis of Borghans et al. (2006) shows that youngsters, and particularly those who recently left school, also have a greater increase in the knowledge relevant to their job. Obviously, this can also be attributed to a combination of formal training and informal learning in the workplace.

Table 2.5: Determinants of knowledge development

	B	Std. Error
Constant	17.313	2.995***
Male	-0.332	0.034***
Age	-1.782	0.675***
Preparatory vocational education	4.131	2.475*
General secondary education	3.862	2.585
Intermediate vocational education	1.789	2.475
Higher vocational education	2.285	2.451
University education	2.154	2.527
Participation in formal training	1.386	0.689**
Duration of training courses	-0.001	0.002
Informal learning	6.940	2.278***
Recently left school	8.546	1.179***

Level of significance: * = 10%, ** = 5%, *** = 1%.

2.8 Conclusions

Although in economic literature other terms are usually used, such as ‘training on the job’ and ‘learning by doing’, there are many studies which analyse workplace learning. Obviously, from the economic perspective, workplace learning is considered to be an investment decision for both the worker and the firm. For this reason, economics studies particularly analyse the returns on these investments in workplace learning from the perspective of the human capital theory.

Another interesting subject in economic literature is the relation between on the one hand technological and organisational innovations and on the other the risks of skill obsolescence and the opportunities for workplace learning offered by these innovations. Furthermore, since the last decade, many studies have been published on the High Performance Workplace. In this HPW, workplace learning plays an important role. Moreover, the HPW can be linked to the need for intertask learning and the importance of behavioural and ‘people skills’. Moreover, labour economists nowadays have a greater interest in opening the black box of human capital by distinguishing between different skills or competencies.

Finally, a recent study was presented in which the impact of workplace learning on the knowledge development of workers was measured. It is an example of the approach economists like to follow in empirical research. Without bothering too much about conceptual issues, they attempt to develop an operational measure which may contribute to both our insights about the relevance of workplace learning and the critique of others who may take over the baton.

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NOTES

- ¹ Van Loo and De Grip (2003) found similar large effects of training participation on productivity and the Return on Sales.