

Informal Learning and Labour Market Returns. Evidence from German Panel Data

Ina Elisabeth Rüber^{1,*} and Thijs Bol²

¹German Institute for Adult Education - Leibniz Centre for Lifelong Learning, Heinemannstraße 12-14, 53175 Bonn, Germany and ²University of Amsterdam, 1012 WX Amsterdam, Netherlands

*Corresponding author. E-mail: rueber@die-bonn.de

Submitted December 2016; revised September 2017; accepted October 2017

Abstract

Informal learning, the self-initiated acquisition of knowledge, takes a central position in political and scientific debates on skill formation. Human capital theory argues that informal learning increases skills and thereby will positively affect returns in the labour market. Signalling and closure theories do not expect returns to informal learning, as informal learning does not result in a formal degree. So far only a few studies have empirically investigated how informal learning affects labour market outcomes, all of them applying a cross-sectional design. By using the German National Educational Panel Study (NEPS), we model the returns to three forms of informal learning in person fixed-effects models, thereby reducing problems of selection into informal learning. We find that up to 33 per cent of the respondents engage in at least one form of professional purpose informal learning. While participation is high, the effects on labour market returns are negligible. We find a very small positive effect of one of the three types of informal learning on employment, and we find no effect of informal learning on wages.

Introduction

Lifelong learning takes a central position in both political debates (Dohmen, 1998; United Nations General Assembly, 2015) and scientific debates (Field, 2000; Tuijnman and Boström, 2002) on skill formation in the light of changing labour markets. It is often argued that lifelong learning will enhance workers' labour market prospects (European Commission, 2002). One of the primary ways by which individuals can increase their skills after formal education is by informal learning, which can be distinguished from formal learning and non-formal learning (Field, 2011). Formal learning takes place in the formal education system, often leading to standardized educational credentials. Adult education courses, leading to at least a certificate of participation,

are classified as non-formal learning (Ehlert, 2017). Informal learning, however, is detached from any externally configured place, curriculum, or time and hence rarely leads to a visible accreditation.

In this article we investigate how informal learning affects labour market returns. While there already exists a relatively well-established discussion on the benefits of formal and non-formal learning (Schuller *et al.*, 2004; Jenkins, 2011), research on the benefits of informal learning is still in its infancy. The main mechanism that hypothesizes positive effects of learning is similar for all three forms: human capital theory predicts positive returns to skill investment, both in terms of employment and wages. Since informal learning—just like formal learning and non-formal learning—increases the human

capital of workers, we would expect to see a payoff to it in the labour market. Credentialing and signalling theories (Bills, 2003; Bol and van de Werfhorst, 2011), however, do not expect returns to informal learning. These theories argue that learning only pays off when it results in an observable signal, such as a degree or accreditation in some form. Since an observable signal is per definition absent in informal learning, credentialing and signalling theories suggest that informal learning does not affect labour market outcomes.

Irrespective of credentialing and signalling theories, in political discourse there is a strong tendency to believe that informal learning will improve success in the labour market, although very few studies have actually empirically investigated this relation (Desjardins, 2003; Fahr, 2005; Fröhlich *et al.*, 2014). Moreover, all of the existing studies relied on a cross-sectional design, in which identifying an effect of informal learning is difficult because of the selection of individuals with specific attributes into informal learning (Halliday-Wynes and Beddie, 2009; Kuper and Kaufmann, 2010; Livingstone, 2001).

In this article, we make two contributions to the existing literature on the labour market returns to informal learning. First, we look in a more systematic way at the labour market returns to informal learning. Next to non-formal learning (Ehlert, 2017), informal learning is seen as an important way to overcome skill deficiencies that might develop over the life course (Merriam, Caffarella and Baumgartner, 2012). At this moment, we do not know if informal learning has such positive effects. Some theories expect a positive effect (human capital theory), but others are sceptical of wage and employment effects of informal learning (credentialing and signalling). In our study we analyse the effects of three forms of informal learning: (i) visiting specialized trade fairs or congresses, (ii) attending special lectures, and (iii) using any computerized learning programs or similar materials.

Second, our study is the first to estimate the effects of informal learning by using panel data. Fahr (2005) studies the association between informal learning and wages, but rightfully notes in his discussion ‘a detailed analysis of the returns to informal education is awaiting the availability of longitudinal data with information on wages and participation in informal education’ (p. 92). In this article, we take up this task and study returns to informal learning using two different analytical strategies. First, we estimate a cross-sectional model, which is still state of the art (Fröhlich *et al.*, 2014). Next, we estimate an individual fixed-effects model using longitudinal data from the German National Educational Panel

Study (NEPS). In the fixed-effects approach, we model within-individual variation in employment and wages by within-individual variation in informal learning, thereby overcoming problems of time-invariant selection into informal learning.

Informal Learning

Informal learning is a diffuse concept, and existing literature is mainly occupied with the attempt to find a proper definition. Hager (2012) notes that informal learning is often defined by what it is *not*, most often by demarcating it clearly from formal and non-formal learning. Formal learning takes place in the formal education system, non-formal learning encompasses educational activities that take place once an individual has entered the labour market (job-related training, adult education, courses), and informal learning covers all learning activities that do not fall in either of the other two categories.

Some scholars try to define informal learning in itself. One of the most influential stances nowadays goes back to Marsick and Watkins (1990) defining informal learning based on responsibility disparities to other forms of learning. It can occur everywhere, but it is not typically classroom-based (formal), and it is rarely structured (formal and non-formal). Crucially, the learner controls the learning activity him or herself. In contrast, with formal learning it is the teacher’s responsibility to deliver knowledge to the learner. In informal learning it is the responsibility of the learner to acquire knowledge from whatever medium he or she is using, while it does not need to be intended but can also occur incidentally (see also Kleinert and Matthes, 2009). Under these circumstances, everyone is by default an informal learner, as situations of incidental learning are plentiful.

The plurality of definitions highlight the great difficulty of measuring informal learning in a quantitative way, which Clarke (2005) recognizes as the reason why existing research rarely focuses on measuring outcomes and is predominantly qualitative in nature. The strategy within the limited amount of studies investigating the returns to informal learning is to narrow informal learning down to very specific contexts and activities. Fahr (2005) measures informal learning by using self-reported educational activities, where informality results from outside work-time activity and learning from human capital enhancing activities (as considered by the coders). His definition of informal learning is broad, and even includes reading (non-fiction) books. Desjardins (2003) defines informal learning by separating between informal job-related learning and informal

personal interest-related learning. The first is measured through learning situations in and around work, and the latter captures intensity of reading books and writing letters at home as well as visits to the library.

We follow a similar approach as Fahr (2005) and Desjardins (2003), and provide a practical definition of informal learning, mainly based on the ideas of Marsick and Watkins (1990). Informal learning should fulfil the following three criteria: (i) the learner initiates and processes the learning activity him or herself, (ii) the learning activity is disentangled from any given place or time (unlike formal and non-formal learning), and (iii) the learning activity results in knowledge gain. Informal learning can thus be defined as the self-initiated acquisition of knowledge in which the learner himself or herself chooses the means, place, and time independently.

Following this definition, our article clearly delimitates from the on-the-job training or workplace learning literature (Bassanini *et al.*, 2005). Here, learning is tied to the context of work, and it is often initiated by the employers instead of the employee. Moreover, workplace learning and on-the-job training often take place in settings which include a teacher–student relation, as well as a pre-constructed curriculum and significant monetary costs. A recent study has focused on this type of learning in the labour market and found that wage returns depended on the type of firm and the financier of training (Ehlert, 2017).

Participation in Informal Learning

How many individuals participate in informal learning? Livingstone (2001) analyses Canadian adults and asks whether respondents participated in different types of informal learning, regardless of how they did it and when. The reported participation rates among Canadian adults are high, varying from 62 to 74 per cent. A similar percentage is found for Australia (Halliday-Wynes and Beddie, 2009). Kuper and Kaufmann (2010) summarize the existing empirical work by stating that participation rates in informal learning are high and that this is largely explained by work-related learning at work. Based on the German *Berichtssystem Weiterbildung* (2003), a national monitoring survey of continuing education and training activities, the authors calculate participation rates in work-related informal learning up to almost 46 per cent. More recently, using data from the German National Panel Study, Kruppe and Trepesch (2017) find more than 60 per cent of the respondents engaging in general and work-related informal learning. One of the main predictors of participation in informal learning is participation in (non-)formal

learning. Several studies (Fahr, 2005; Desjardins and Tuijnman, 2005; Livingstone and Stowe, 2007) find that highly educated individuals also spend more of their leisure time on educational activities than the lower educated. In a similar way, studies find that participation rates in informal learning differ between ethnic groups (Smith and Smith, 2008), age groups (Tikkanen, 2002; Kremer, 2005), and individuals that have differing levels of social capital (Strawn, 2003).¹

From the existing literature, two things become clear. First, participation in informal learning is high. Secondly, most studies indicate that there is systematic variation in participation in informal learning among groups of individuals who differ on, for example, their educational and ethnical background. This uneven selection of individuals in informal learning is important when we want to estimate its labour market returns.

Labour Market Returns to Informal Learning in the German Context

Widening socio-economic disparities (Dieckhoff, 2007), aging societies (Fröhlich *et al.*, 2014), or simply an ever more technologizing world (Preston and Dyer, 2003) are the triggers for researchers from different disciplines to analyse the labour market returns to informal learning. The idea that informal learning might increase success on the labour market stems from human capital theory (Becker, 1964). The acquisition of knowledge and skills is an investment in one's human capital, thereby increasing the marginal returns to work. Extensions of human capital theory take a less individualized perspective on how learning pays off, and argue that returns might vary by the type of acquired skills (general vs. specific) and the cost of learning (Van Smoorenburg and van der Velden, 2000; Booth and Bryan, 2005). Irrespective, the general expectation is thus that informal learning—just like all other forms of learning—increases the labour market position of workers, both in terms of employment and wages.

While human capital theory expects a payoff to informal learning because of skill acquisition, other theories do not hypothesize such an effect. An important characteristic of informal learning is that it can be done anytime, anywhere, and—in contrast to (non-)formal learning—is not attached to an (accredited) degree. Signalling theories (Spence, 1973; Arrow, 1973) argue

- 1 While most studies find that there are clear differences in the participation in informal learning, there are also a few studies that argue for the opposite (Livingstone, 2001).

that information on potential productivity is very difficult to observe for employers, and educational rewards are predominantly based on characteristics that signal potential productivity. Educational degrees are crucial signals, and since these are absent in informal learning, signalling theories do not expect a labour market return. Similarly, credentialing theories (Collins, 1979) emphasize the importance of educational degrees (credentials) when it concerns payoff to learning. The status that is associated with an accredited degree provides access to more rewarding positions in the labour market. Just like with signalling theory, learning that does not result in a degree is not expected to improve an individual's labour market position.

So far it is unclear if informal learning indeed increases labour market returns (human capital theory) or not (signalling and credentialing theory). Empirical evidence for labour market effects of informal learning is contradictory and scarce. Fröhlich *et al.* (2014) analysis of a cross-sectional survey shows that learning activities at work, such as feedback and information seeking, result in greater employability. Desjardins (2003) focuses on a cross-section in Canada and finds a negative effect of informal personal interest learning and a positive effect of informal job-related learning on wages. Fahr (2005) investigates the determinants to spend leisure time on informal learning activities, considering informal learning to increase market productivity but also to represent 'high quality' leisure. Using cross-sectional time-use data, he finds a positive relation between informal learning and wages.

Following human capital theory, the main hypothesis of our study is that informal learning increases the skills and knowledge of workers and will therefore have positive effects on their likelihood to be employed and their wages. A contradicting hypothesis stems from signalling and credentialing theories, that both argue that informal learning is not associated to a larger employment probability and higher wages, since it is per definition not connected to a degree.

Our study focuses on the German context. Literature on the returns to education and training suggests that the institutional context of a country affects both the size and significance of participation in and returns to training. For example, Dieckhoff, Jungblut, and O'Connell (2007) find that union density, wage compression, employment protection, and the degree of coordination are important institutional determinants. Vogtenhuber (2015) argues that the differing skill formation systems strongly matter for the size of potential returns. Here, both quality of and access to initial education are crucial to average training returns. The German

institutional context is characterized by a highly stratified and vocationally specific education system, as well as a segmented labour market (Ehlert, 2017). More than in other countries, wages in Germany are coordinated through collective bargaining, which lowers the chance for spontaneous wage increase in specific occupations. It is important to take this into account when interpreting our findings: it might be the case that informal learning has much smaller effects in Germany than in a country with a less regulated labour market.

Even within the segmented labour market of Germany, there are likely to be differences in the extent to which informal learning pays off. Workers in regulated public sector occupations might see lower returns to informal learning, as their efforts do not result in a formal accreditation that is connected to collectively bargained wages. In the private sector, this could be different, as the remuneration will be more directly connected to productivity. It reaches beyond this study to examine how within-country differences affect informal learning, so one needs to consider that we are only looking at average effects for the whole German labour market.

Data

To identify the effects of informal learning, we estimate two different models: cross-sectional models and fixed-effects models. We use data from the sixth starting cohort *Adult Education and Lifelong Learning* (SC6) of the German NEPS founded in 2009 (Blossfeld, Rossbach and von Maurice, 2011). The NEPS collects high-quality longitudinal data on educational processes, decisions, returns, and the development of competencies on an annual base, using computer-assisted personal and telephone interviewing (CAPI and CATI). It aims to capture learning and education throughout the whole lifespan and within formal, non-formal, and informal contexts.

The adult cohort sample builds upon the *Working and Learning in a Changing World* (ALWA 2007/2008) survey (Kleinert *et al.*, 2011), which functions as first wave. Data from Wave 2 (2009/2010) entail ALWA respondents, a refreshment of the ALWA subsample, and a pile up of older cohorts. To balance panel mortality and to provide sufficiently large samples, another refreshment took place in Wave 4 (2011/2012). The present study uses data from Wave 3 (2010/2011) to 7 (2014/2015)² for the longitudinal models and data from Wave 7 for the cross-sectional models, since this is the

2 Panel file: *pTarget*, spell files: *spEmp*, *Biography*, *FurtherEducation*, and event file: *Education*.

latest data available and hence most accurately pictures today's German labour market processes. The first wave (ALWA) and the second wave do not include information on the purpose of informal learning and hence do not provide for a sufficient database for this study.

We restrict our samples to adults below the age of 65 years, who are currently not in full-time education or on leave and who are not yet retired. Each respondent who took part in at least two consecutive waves is included in the longitudinal analysis. The wage analyses samples correspond to the employment analyses samples, minus unemployed respondents and minus those, reporting missing values on labour-related controls and the wage variable. We have decided against the imputation of missing values on wages, since major sample characteristics do not change substantially after the exclusion of respondents, not reporting their wages (see [online Appendix Table C1](#)). Following common practice in wage equations, we delete the bottom and top 1 per cent of the distribution to eliminate outliers in the analytical samples of our wage models. Keeping them in provides the same results (see [online Appendix Table D1](#)). For more details about the sample derivation, Appendix Table A1 includes a table describing how many and where we lose cases, going from the raw data to the analytical samples. Note that in Wave 4, many NEPS respondents have not been asked about the purpose of learning. We lose a substantial amount of cases here.

In general, of the 17,140 respondents in total, almost 22 per cent took part in all waves. While 32 per cent are marked by late entry, due to the refreshments and augmentation in Waves 2 and 4. The share of temporary non-response is very low, as only 10 per cent drops out. To make sure that the sample remains representative for the German population belonging to birth cohorts 1944–1986, the NEPS team uses a two-stage cluster sampling approach, based on German municipalities as elementary and persons as secondary sampling unit ([Aßmann et al., 2011](#)). It also provides weights for each wave. In case of using the balanced sample, it is suggested to apply the weights. Since we make use of the unbalanced data, we do not include weights in our longitudinal analysis (cf. [Rohwer, 2011](#)). To ensure comparability of our results, we do not use weights in the cross-sectional analysis either.

Variables

We test the effects of informal learning on two labour market outcomes, employment, and wages. Employment is measured as a dummy variable, where 1 represents being employed (including self-employment)

at the time of the interview and 0 means that the respondent is unemployed. Respondents reported both weekly work hours and monthly gross income. From this information, we derive log gross hourly wages as second dependent variable.

Our major challenge is to operationalize informal learning. The survey provides four items, which are asked in five consecutive waves. We only use three out of the four, because we need information of a follow-up question, which is only available for those three items. The interviewer introduces the set of questions with the sentence: 'Learning can also be done completely without regulated class and course routines. Since the last interview did you...?', and continues with specific cases:

1. '...visit **special trade fairs or congresses**, to learn more on your own in the professional or private field?'
2. '...visit **specialized lectures, presentations or keynote speeches**, to learn more on your own in the professional or private field?'
3. '...use any **computerized learning programs**, learning CDs or DVDs or similar materials in order to enhance your private or professional knowledge?'

Our definition of informal learning has two major attributes: (i) the learning is self-initiated independently, and (ii) that it is an activity of acquiring knowledge, which are both met in the proposed measures. None of the activities described is obligatory to the participant. Moreover, the questions make clear that the purpose of all activities is the acquisition of knowledge.

These measures circumvent the problem of measuring activities, which could be informal learning, but without the intention to be learning. This problem for instance occurs in [Fahr's \(2005\)](#) measures, where coders chose which activities could be informal learning, but the respondent himself or herself did not indicate knowledge acquisition was the main goal. Another advantage of our measures is that they cover a range of activities. A follow-up question provides for information if the informal learning was meant to enhance private or professional knowledge. In our analyses, we only look at the effects of informal learning when the purpose was the acquisition of job-related knowledge (instead of non-job-related knowledge).

We generate three independent dummy variables for informal learning, which take on the value 1 if the respondent indicated to have done informal learning for professional reasons or professional and private reasons and 0 if the respondent did not do informal learning or only for private reasons. For the third type of informal

learning (computer learning programs), the phrasing of the question changed after one wave. Although our measures align very well with the measures that have been used in previous studies, we are aware that we are only looking at a limited number of potential forms of informal learning, which is important when drawing conclusions from our results.

To account for potential interconnectedness of informal, formal, and non-formal learning, we include other indicators of learning. First, we include a dummy variable measuring whether the respondent took courses outside of formal education within the past 12 months prior to the respective interview date. Secondly, we include a categorical variable entailing the highest educational degree, distinguishing between low (none and elementary), medium (intermediate and general/vocational maturity), and high (lower and higher tertiary).

To further control for attributes and conditions, which showed to be predictive for wages and employment and might be correlated with participation in informal learning, we include a rich set of control variables. We measure demographic differences by using continuous age (mean-centred for the analysis), age-squared, sex of the respondent, categorical migration background (native; first generation; second generation), parental education (low, medium, and high education), family status (single, married or long-term partnership, divorced or widowed), children in the household (yes, no), self-perceived health (good, average, poor). We also include several factors that are related to job characteristics of respondents: the size of the firm (less than 10, 11–99, 100, and more), whether the respondents switched employer, and the socio-economic status measured by the International Socio-Economic Index of Occupational Status (ISEI) of the respondent's current job (Ganzeboom, De Graaf and Treiman, 1992). This last set of covariates is only included in the analyses where we model wages. By controlling for ISEI, employer change, and firm size, we might omit the potential indirect effect of informal learning, which goes through promotion or firm change. A stepwise inclusion of the three employment specific controls does not change our main results.

Table 1 shows the descriptive statistics for all variables and the different samples that we analyse. Time-invariant variables, migration background, education, parents' education and sex have (nearly) zero within-individual variation and therewith fall out of the longitudinal models. Finally, we include a categorical variable with wave information in the longitudinal models, to account for year specific labour market changes.

Analytical Strategy

First, we analyse a set of models to estimate the effects of informal learning in a cross-sectional design. We start estimating a model on employment and wages without control variables, and then with control variables. Identifying effects of informal learning in such a way is comparable to what has been done in previous work (Desjardins, 2003; Fahr, 2005; Fröhlich *et al.*, 2014).

A shortcoming of the cross-sectional model is that it disregards time-constant unobserved factors, such as social class, or cognitive ability. The second set of analyses takes this into account. Here we analyse how a change in participation in informal learning affects a change in either employment or log hourly wages. Circa 55 per cent of the respondents included in the analytical samples of the longitudinal analyses change their informal learning status at least once in at least one type of informal learning. With 43 per cent of the employment analysis sample respondents changing the usage of self-learning programs at least once, media-based informal learning is most volatile (38 per cent change in lecture visits and 28 per cent change in congress visits, respectively). We analyse the panel data in fixed-effects models. By adding a fixed effect for each individual, we only exploit within-person variation between the waves. Fixed-effects models tackle the problem of unobserved heterogeneity to a greater extent than cross-sectional regressions, since they eliminate all time-constant differences between respondents. The fixed-effects models will give a more robust estimate of the effect of informal learning on employment and wages, since they take care of a substantial part of the selection problem. Of course, in these models, there is still the assumption that there are no unobserved time-varying factors: it might be that some individuals are more likely to enrol in informal learning after a job change, for example. While the assumption of no unobserved time-invariant factors is strong, the panel analyses are a clear improvement over the existing state of the art: cross-sectional analyses.

Both employment and log hourly wages are modelled in linear regression models, making the estimation of employment effectively a linear probability model (with robust standard errors). We prefer the linear probability models, since the parameter estimates can be directly interpreted in their effect on the outcome, which is not possible with for instance logistic models (Greene, 1993). Moreover, we are able to compare effect sizes between different models.

Results

Before we discuss our multivariate results, we present some descriptive statistics on participation in informal

Table 1. Descriptive statistics of dependent, independent, and control variables

	Cross-section sample				Longitudinal sample							r
	N = 5,640		N = 7,428		N = 24,620			N = 34,862				
	M	SD	M	SD	M	SD	w-SD	M	SD	w-SD		
<i>ln wages</i>	2.82	0.50			2.80	0.50	0.18					0.55–4.11
Employment	1	0	0.95	0.21	1	0	0	0.95	0.21	0.11		0–1
<i>Informal learning</i>												
Congress	0.16	0.36	0.16	0.37	0.16	0.37	0.25	0.17	0.37	0.25		0–1
Lecture	0.18	0.39	0.18	0.38	0.19	0.39	0.27	0.19	0.39	0.27		0–1
Media	0.15	0.35	0.14	0.35	0.16	0.37	0.25	0.16	0.36	0.26		0–1
<i>Education</i>												
High	0.33	0.47	0.32	0.47	0.32	0.46	0.04	0.31	0.46	0.05		0–1
Medium	0.52	0.50	0.52	0.50	0.52	0.50	0.04	0.51	0.50	0.04		0–1
Low	0.15	0.36	0.16	0.37	0.17	0.37	0.04	0.17	0.38	0.04		0–1
Gender	0.49	0.50	0.49	0.50	0.48	0.50	0.01	0.49	0.50	0.02		0–1
<i>Migration status</i>												
Native	0.83	0.37	0.83	0.37	0.83	0.37	0	0.83	0.37	0		0–1
First generation	0.08	0.27	0.08	0.27	0.07	0.26	0	0.08	0.27	0		0–1
Second generation	0.09	0.29	0.09	0.29	0.09	0.29	0	0.09	0.29	0		0–1
<i>Parents' education</i>												
High	0.20	0.40	0.20	0.50	0.19	0.39	0	0.19	0.39	0		0–1
Medium	0.26	0.44	0.26	0.44	0.26	0.44	0	0.26	0.44	0		0–1
Low	0.54	0.50	0.54	0.40	0.55	0.50	0	0.55	0.50	0		0–1
<i>Health</i>												
Good	0.73	0.45	0.71	0.46	0.71	0.46	0.26	0.70	0.46	0.27		0–1
average	0.24	0.43	0.25	0.43	0.25	0.44	0.28	0.26	0.44	0.29		0–1
poor	0.03	0.17	0.04	0.20	0.03	0.18	0.12	0.04	0.21	0.14		0–1
Age	47.29	9.18	47.66	9.23	46.40	9.15	1.12	46.73	9.35	1.18		21–64
Non-formal learning	0.49	0.50	0.47	0.50	0.63	0.48	0.28	0.60	0.49	0.29		0–1
Children in HH	0.53	0.50	0.52	0.50	0.54	0.50	0.16	0.53	0.50	0.17		0–1
ISEI	52.39	20.57			51.90	20.59	3.48					11.56–88.96
<i>Firm size</i>												
<10	0.22	0.41			0.21	0.41	0.10					0–1
≥10<100	0.35	0.48			0.36	0.48	0.12					0–1
≥100	0.43	0.50			0.43	0.50	0.10					0–1
Change employer	0.09	0.29			0.09	0.29	0.23					0–1

Source: Own calculations using NEPS (SC6), Wave 7/3–7, version 7.0.0, doi:10.5157/NEPS:SC6:7.0.0.

Note: HH = household; M = mean; SD = standard deviation; w-sd = within standard deviation; r = maximum range (longitudinal sample).

learning. These descriptive statistics are based on cross-sectional samples.

Descriptive Results

Table 2 reports participation in informal learning for professional reasons by employment, education, and occupation. First, we see that attending specialized lectures is the most common form of informal learning (see also Table 1). For using self-learning programs, we find the lowest participation rates.

With respect to employment, we find that the employed are more likely to participate in all different

types of informal learning. The difference is most pronounced for attending specialized lectures. There is a stratified pattern with respect to education as well. The high educated are more likely to participate in any form of informal learning by a factor of three or more times as much as the low educated. An estimated 32 per cent highly educated attends specialized lectures for professional reasons. With respect to occupation, the results are more heterogeneous. Although managers and professionals are often among the most likely to participate in informal learning, workers in skilled agricultural, forestry, and fishery occupations also tend to participate

Table 2. Proportion of informal learners for professional reasons by employment, education, and occupational groups

	Visit trade fairs or congresses	Attend specialized lectures	Use self-learning programs
Employment			
No	0.05	0.05	0.08
Yes	0.17	0.19	0.14
Education			
Low	0.07	0.05	0.06
Medium	0.12	0.14	0.13
High	0.27	0.32	0.19
Total	0.16	0.18	0.14
Number of observations	7,428	7,428	7,428
Occupation			
Managers	0.35	0.34	0.19
Professionals	0.26	0.32	0.21
Technicians and ass. prof.	0.11	0.17	0.14
Clerical support workers	0.07	0.09	0.16
Service and sales workers	0.08	0.05	0.08
Skilled agricultural/forestry/fishery	0.32	0.35	0.03
Craft and related trades workers	0.11	0.08	0.08
Plant and machine operators	0.06	0.02	0.11
Elementary occupations	0.03	0.03	0.02
Total	0.16	0.18	0.15
Number of observations	5,640	5,640	5,640

Source: Own calculations using NEPS (SC6), Wave 7, version 7.0.0, doi:10.5157/NEPS:SC6:7.0.0.

Note: Cross-sectional analysis samples.

quite extensively (self-learning programs excluded). Participation is comparatively low for workers in elementary occupations, plant and machine operators, and assemblers.

Table 2 makes clear that there are large differences in the extent to which individuals participate in informal learning. In our multivariate models, we will investigate if these factors can explain the correlation between informal learning and, respectively, wages and employment.

Wages

Table 3 (Models 1 and 2) reports the results from the cross-sectional analysis. Model 1 comprises only the three types of informal learning, all showing positive and significant effects on log hourly wages. The wage effect is largest for attending a lecture, indicating an estimated wage increase of 21 per cent ($e^{0.19}$). Similarly, substantial effects are found for attending a congress (14 per cent) or using self-learning programs (16 per cent).

Of course, these correlations are uncontrolled for potential confounders. In Model 2 we add all our control variables. The effects of the control variables can be found in Appendix Table B1. After adding our control

variables, the effects of informal learning decrease substantially, but remain statistically significant.

To get a better grasp on how robust these effects are, we estimate fixed-effects models (Model 3). The models consist of our major independent variables and time-varying control variables (see Appendix Table B1). Model 3 makes clear that in the fixed-effects models, where we take out all time-constant variance between respondents, the positive effects of informal learning disappear. All effects of informal learning on log hourly wages are insignificant and, more importantly, very close to zero. These results indicate that informal learning, as measured here, does not affect wage returns in the labour market.

Employment

Looking at the associations between the three forms of informal learning and employment, we see again that all three forms provide significant effects (Model 4). We estimate that those who go to a congress or use self-learning programs have about a 2 percentage points higher employment rate and 3 percentage points for those who go to specialized lectures. Of course, reverse causality could be an important explanation here, as it is

Table 3. The effect of informal learning on log hourly wages and employment. Cross-sectional and fixed-effects models

	Log gross hourly wages			Employment		
	1 CS	2 CS	3 FE	4 CS	5 CS	6 FE
Informal learning						
Congress	0.135*** (0.02)	0.036* (0.02)	0.001 (0.01)	0.023*** (0.00)	0.013** (0.00)	0.003 (0.00)
Lecture	0.194*** (0.02)	0.036* (0.02)	-0.001 (0.01)	0.031*** (0.00)	0.018*** (0.00)	0.007* (0.00)
Media	0.151*** (0.02)	0.044** (0.01)	-0.010 (0.01)	0.019** (0.01)	0.008 (0.01)	-0.010*** (0.00)
Control variables	No	Yes	Yes	No	Yes	Yes
N	5,640	5,640	23,054	7,428	7,428	34,862
R ²	0.062	0.427		0.008	0.066	
AIC	7,924.6	5,181.1		-1825.9	-2245.1	

Source: Own calculations using NEPS (SC6), Wave 7/3–7, version 7.0.0, doi:10.5157/NEPS:SC6:7.0.0.

Note: (Robust) standard errors in parentheses. Appendix Table B1 displays point estimates for control variables. AIC = Akaike information criterion; CS = cross section; FE = fixed effects.

* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$.

not only going to a congress that affects being employed, but also the other way around.

After adding control variables (Model 5), both the effect of going to a congress and attending specialist lectures remain significantly different from zero. Although the effects are small, these results support a human capital interpretation of informal learning, and would make a case for informal learning: individuals who invest in informal learning are more likely to be employed.

In Model 6 we again regress employment on informal learning, but this time in person fixed-effects models. Taking out all between-person variance, we still find significant effects of informal learning on employment. The already small effect of going to a congress disappears. The effect of going to a specialized lecture remains but decreases substantially to approximately 0.7 per cent. The effect of using self-learning programs even becomes negative but also close to zero (1 per cent). The effect sizes are negligible. Based on these results, we conclude that there are some effects of informal learning on employment, but they are very small.

To summarize the main results, Figure 1 presents the point estimates of the cross-sectional models and the fixed-effects models. The left panel shows the results from the cross-sectional analyses. Most forms of informal learning have positive effects on employment and wages, and their effects are small but substantial. The right panel shows the results from the fixed-effects analyses. Here we see that all predicted effects are very small and most of them are not significant. Overall, informal learning seems to have no effect on employment or wages.

Robustness Checks

We have performed several robustness checks. Here, we only summarize the main findings, and all details can be found in Online Appendix E. First, logistic regression models provide largely the same results as our linear probability models, subscribing our main finding that informal learning does not increase the likelihood of being employed.

Secondly, we have estimated our cross-sectional models over all waves with a pooled regression mode. There is only minor variation in the log gross hourly wage models, and the general interpretation of the results does not change.

Thirdly, in our fixed-effects regressions, we use an unbalanced panel. When we use a balanced panel, the results as reported in the article remain largely the same.

Fourthly, wages and employment probabilities vary by occupational groups respondents are trained for. We therefore controlled for the previous or current occupation of the respondent when modelling employment, and for current occupation when modelling wages. There is only marginal variation in the size and significance of the effects, implying that the small effects of informal learning on employment and no effects on wages are not present or absent due to heterogeneity across occupational groups.

Fifthly, the productivity increase by informal learning may pay off later than expected in our models or the exposure to informal learning may need to be more intense. We ran both, models with lagged (1 year) informal learning variables and models with a changed

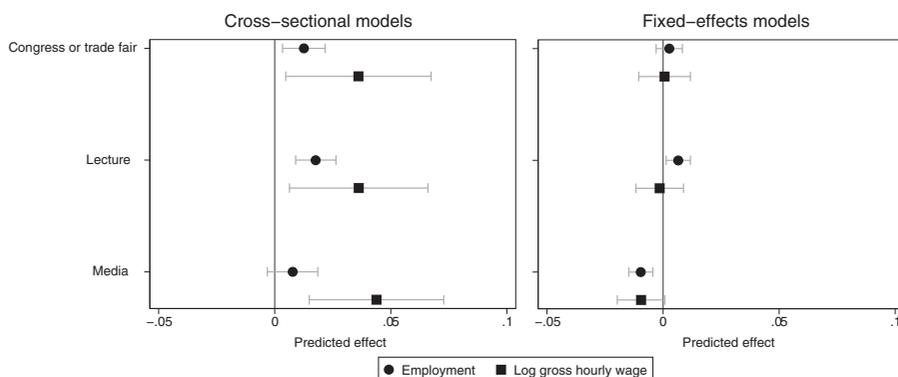


Figure 1. Marginal effects for the different forms of informal learning, both from cross-sectional and fixed effect designs
Note. The marginal effects are obtained from Table 3, Models 2 and 5 for the point estimates of the cross-sectional models and Models 3 and 6 for the point estimates of the fixed-effects models.

coding of informal learning, with 1 indicating at least consecutive 2 years in which the respondent reports informal learning. The effect sizes change marginally, and our general finding remains the same.

Finally, the respondents' educational degree might influence the effect size and significance of informal learning on wages and employment. In our last robustness check, we ran interactions between having a high educational degree and the different types of informal learning. Our major findings remain the same.

Conclusion

In this article, we have investigated if informal learning increases returns in the labour market. Although policy-makers have strong faith in lifelong learning, the empirical evidence of returns to informal learning is scarce and restricted to studies that use cross-sectional designs. We focused on three forms of informal learning: (i) attending a congress or trade fair, (ii) attending a specialized lecture, and (iii) using self-learning programs from diverse media. Our analyses of the effects of these three forms of informal learning on employment and wages among German adults provide two conclusions.

First, we find that the three forms of informal learning that we were able to analyse have no effects on wages, and only very small effects on employment. In a fixed-effects model, only going to specialist lectures has a significant positive effect on employment, although the size of the effect is very small. We also find a small negative effect of using self-learning programs on employment. For wages, we find no effects of informal learning. All point estimates are close to 0 and not statistically significant. Irrespectively, our main conclusion is

that the forms of informal learning that we have studied have no or very small effects. This contradicts findings of earlier studies (Desjardins, 2003; Fahr, 2005; Fröhlich *et al.*, 2014).

Secondly, our results show that cross-sectional designs give a wrong impression. When we analyse the association between informal learning and our two outcomes in a cross-sectional design, the results are different. Here most of the effects are stronger and significantly different from zero. It indicates that to find out what the true (causal) effects of informal learning are, cross-sectional analyses are not sufficient. Apparently, an important reason as for why informal learning seems to pay off in a cross-sectional design has to do with selection into informal learning.

Our findings thus contradict human capital theory, which expects positive effects of informal learning as long as it improves knowledge and skill acquisition. Instead, our analyses support signalling and credentialing theories that argue that learning only pays off in the labour market if it results in (accredited) degrees. Colardyn and Bjornavold (2004) argue that validation of learning is a key problem. If skills and competences are potential outcomes of lifelong learning practices, the outcome only becomes influential if it can be identified, assessed, and recognized. Ehlert (2017) concludes the same in his analyses of non-formal learning: only when there is accreditation, non-formal learning results in higher wages. Our results point to the same direction: investment in informal learning might make workers more productive, but when employers are not able to see this, it will not change the labour market outcomes of workers.

Of course this article also has limitations. In our analyses we did not analyse the intensity or quality of informal learning, just *if* someone participated in informal learning for professional purposes. Although this is a crucial step, it is likely that the effects to informal learning vary by the intensity or quality of it. Attending a lot of lectures might be beneficial, or participating in high-quality or high-status conferences might lead to larger wage gains. Secondly, we only focused on three different types of informal learning. The three forms entail a wide variety of different types of informal learning, but there are more ways by which individuals can obtain skills outside of formal education or organized forms of non-formal education. Thirdly, our analyses are limited to Germany. It might be that the strong emphasis on formal accreditation of learning in the German labour market (Bol and Weeden, 2015; Ehlert, 2017) results to comparatively low returns to informal learning. In a more open labour market, informal learning could result in better labour market prospects. More generally, future research should take up the task to see in what contexts (countries, occupations, sectors) informal learning does pay off—something that reached beyond the scope of what we were able to do in this study.

Irrespective of the limitations, our study indicates that policymakers' strong belief in the effects of lifelong learning and informal learning might be questionable. We do not find that our three forms of informal learning significantly improve the labour market position of individuals who participate in it. A nuanced view on what individuals can achieve with informal learning is necessary.

Acknowledgement

This article uses data from the NEPS: Starting Cohort Adults, doi:10.5157/NEPS:SC6:7.0.0. From 2008 to 2013, NEPS data were collected as part of the Framework Program for the Promotion of Empirical Educational Research funded by the German Federal Ministry of Education and Research (BMBF). As of 2014, NEPS is carried out by the Leibniz Institute for Educational Trajectories (LIfBi) at the University of Bamberg in cooperation with a nationwide network.

Supplementary Data

Supplementary data are available at *ESR* online.

References

- Arrow, K. J. (1973). Higher education as a filter. *Journal of Public Economics*, 22, 193–216.
- Aßmann, C. *et al.* (2011). Sampling design of the national educational panel study: challenges and solutions [Special issue]. *Zeitschrift Für Erziehungswissenschaft*, 14, 51–65.
- Bassanini, A. *et al.* (2005). Workplace Training in Europe. IZA Discussion Papers, 1640. Bonn, available from: <<http://hdl.handle.net/10419/33575>>.
- Becker, G. R. (1964). *Der ökonomische Ansatz zur Erklärung menschlichen Verhaltens*. Tübingen. Human Capital (2nd ed). New York: Columbia University Press.
- Bills, D. B. (2003). Credentials, signals, and screens: explaining the relationship between schooling and job assignment. *Review of Educational Research*, 73, 441–449.
- Blossfeld, H.-P., Rossbach, H.-G. and von Maurice, J. (Eds.) (2011). Education as a lifelong process—the German National Educational Panel Study (NEPS). In *Zeitschrift für Erziehungswissenschaften*, Special Issue 14. Wiesbaden: Springer VS.
- Bol, T. and van de Werfhorst, H. G. (2011). Signals and closure by degrees: the education effect across 15 European countries. *Research in Social Stratification and Mobility*, 29, 119–132.
- Bol, T. and Weeden, K. A. (2015). Occupational closure and wage inequality in Germany and the United Kingdom. *European Sociological Review*, 31, 354–369.
- Booth, A. L. and Bryan, M. L. (2005). Testing some predictions of human capital theory: new training evidence from Britain. *The Review of Economics and Statistics*, 87, 391–394.
- Clarke, N. (2005). Workplace learning environment and its relationship with learning outcomes in healthcare organizations. *Human Resource Development International*, 8, 185–205.
- Colardyn, D. and Bjornavold, J. (2004). Validation of formal, non-formal and informal learning: policy and practices in EU member states. *European Journal of Education*, 39, 69–89.
- Collins, R. (1979). *The Credential Society: An Historical Sociology of Education and Stratification*. New York: Academic Press.
- Desjardins, R. (2003). Determinants of economic and social outcomes from a life-wide learning perspective in Canada. *Education Economics*, 11, 11–38.
- Desjardins, R. and Tuijnman, A. (2005). A general approach for using data in the comparative analyses of learning outcomes. *Interchange*, 36, 349–370.
- Dieckhoff, M., Jungblut, J.-M. and O'Connell, P. J. (2007). Job-related training in Europe: do institutions matter? In Gallie D. (Ed.). *Employment Regimes and the Quality of Work*. Oxford; New York: Oxford University Press, pp. 77–104.
- Dohmen, G. (1998). *Zur Zukunft der Weiterbildung in Europa: Lebenslanges Lernen für Alle in veränderten Lernumwelten*. Bonn: Bundesministerium für Bildung, Wissenschaft und Forschung.
- Ehlert, M. (2017). Who benefits from training courses in Germany? Monetary returns to non-formal further education on a segmented labour market. *European Sociological Review*, 33, 436–448.

- European Commission (2002). *European Report on Quality Indicators of Lifelong Learning*. Brussels: European Commission.
- Fahr, R. (2005). Loafing or learning? The demand for informal education. *European Economic Review*, **49**, 75–98.
- Field, J. (2000). *Lifelong Learning and the New Educational Order*. London: Trentham Books.
- Field, J. (2011). Researching the benefits of learning: the persuasive power of longitudinal studies. *London Review of Education*, **9**, 283–292.
- Fröhlich, E. D. et al. (2014). Learning to stay employable. *Career Development International*, **19**, 508–525.
- Ganzeboom, H. B. G., De Graaf, P. M. and Treiman, D. J. (1992). A standard international socio-economic index of occupational status. *Social Science Research*, **21**, 1–56.
- Greene, W. H. (1993). *Econometric Analysis*. Englewood Cliffs, NJ: Prentice Hall.
- Hager, P. (2012). Informal learning: a vital component of lifelong learning. In *Second International Handbook of Lifelong Learning*. Netherlands: Springer, pp. 773–785.
- Halliday-Wynes, S. and Beddie, F. (2009). *Informal Learning. At a Glance*. Australia: National Centre for Vocational Education Research.
- Jenkins, A. (2011). Participation in learning and wellbeing among older adults. *International Journal of Lifelong Education*, **30**, 403–420.
- Kleinert, C. et al. (2011). ALWA—new life course data for Germany. *Schmollers Jahrbuch*, **131**, 625–634.
- Kleinert, C. and Matthes, B. (2009). Data in the Field of Adult Education and Lifelong Learning. Present Situation, Improvements and Challenges. RatSWD working paper, 91. Berlin. Available from: <https://www.ratswd.de/download/RatSWD_WP_2009/RatSWD_WP_91.pdf>.
- Kremer, A. L. (2005). *Predictors of Participation in Formal and Informal Workplace Learning: Demographic, Situational, Motivational, and Deterrent Factors*. Fairfax, Virginia: George Mason University.
- Kruppe, T. and Trepesch, M. (2017). Weiterbildungsbeteiligung in Deutschland. Auswertungen mit den Daten der Erwachsenenbefragung des Nationalen Bildungspanels “Bildung im Erwachsenenalter und lebenslanges Lernen”. IAB-Discussion Paper, 16/2017. Nürnberg. Available from: <<http://doku.iab.de/discussionpapers/2017/dp1617.pdf>>.
- Kuper, H. and Kaufmann, D. P. K. (2010). Beteiligung an informellem Lernen. *Zeitschrift Für Erziehungswissenschaft*, **13**, 99–119.
- Livingstone, D. and Stowe, S. (2007). Work time and learning activities of the continuously employed: a longitudinal analysis, 1998–2004. *Journal of Workplace Learning*, **19**, 17–31.
- Livingstone, D. W. (2001). Adults’ Informal Learning: Definitions, Findings, Gaps, and Future Research. NALL Working Paper, 21. Toronto. Available from: <<http://cite.seerx.ist.psu.edu/viewdoc/download?doi=10.1.1.585.3940&rep=rep1&type=pdf>>.
- Marsick, V. J. and Watkins, K. (1990). *Informal and Incidental Learning in the Workplace*. London and New York: Routledge.
- Merriam, S. B., Caffarella, R. S. and Baumgartner, L. M. (2012). *Learning in Adulthood: A Comprehensive Guide*. San Francisco: John Wiley & Sons.
- Preston, R. and Dyer, C. (2003). Human capital, social capital and lifelong learning: an editorial introduction. *Compare: A Journal of Comparative and International Education*, **33**, 429–436.
- Rohwer, G. (2011). *Using Sampling Weights for Model Estimation?* NEPS Working Paper 4. Bamberg: Otto-Friedrich-Universität, Nationales Bildungspanel.
- Schuller, T. et al. (2004). *The Benefits of Learning: The Impact of Education on Health, Family Life and Social Capital*. London: Routledge.
- Smith, M. C. and Smith, T. J. (2008). Low-education adults’ participation in informal learning activities: relationships with selected demographic characteristics. *Adult Basic Education and Literacy Journal*, **2**, 67–73.
- Spence, M. (1973). Job market signaling. *The Quarterly Journal of Economics*, 355–374.
- Strawn, C. L. (2003). *The Influences of Social Capital on Lifelong Learning Among Adults Who Did Not Finish High School*. Cambridge: National Center for the Study of Adult Learning and Literacy, Harvard Graduate School of Education.
- Tikkanen, T. (2002). Learning at work in technology intensive environments. *Journal of Workplace Learning*, **14**, 89–97.
- Tuijnman, A. and Boström, A. K. (2002). Changing notions of lifelong education and lifelong learning. *International Review of Education*, **48**, 93–110.
- United Nations General Assembly (2015). Transforming Our World: the 2030 Agenda for Sustainable Development. UN Doc. A/70/L/1. United Nations General Assembly.
- Van Smoorenburg, M. S. M. and van der Velden, R. (2000). The training of school-leavers. complementarity or substitution? *Economics of Education Review*, **19**, 207–217.
- Vogtenhuber, S. (2015). Explaining country variation in employee training: an institutional analysis of education systems and their influence on training and its returns. *European Sociological Review*, **31**, 77–90.

Ina Elisabeth Rüber, M.Sc., works as a researcher at the German Institute for Adult Education—Leibniz Centre for Lifelong Learning focusing on the theoretical and methodological identification of non-monetary returns to adult learning, since 2016. She is a PhD student and associate member of the LEAD graduate school and research network of the University of Tübingen. She obtained her Research Master degree in Social Sciences from the University of Amsterdam in 2016 and her Bachelor of Arts in Sociology from the University of Mannheim in 2014.

Thijs Bol is an Associate Professor of Sociology at the University of Amsterdam. His research interests are in occupations, inequality, the transition from school to work, and social stratification. In a current research project, he investigates school-to-work linkages from a country-comparative perspective. His work has been published in journals such as *American Journal of Sociology*, *American Sociological Review*, *Sociological Science*, and *Social Forces*.

Appendix

Table A1. Missing data: derivation of analytical samples

	Cross-section samples Wave 7		Longitudinal samples Waves 3–7	
	Cases lost	Cases left	Cases lost	Cases left
Complete sample		9,770		55,539
+ Missing data on informal learning	11	9,759	5,333	50,206
+ Missing data on general controls	221	9,538	28	50,178
+ Sample restriction to respondents below the age of 65 years, not back in education, not on leave/gap and not retired	2,104	7,434	9,350	40,828
Employment				
+ Missing data on outcome	6	7,428	49	40,779
+ <i>Less than two consecutive waves</i>			5,917	34,862
Log gross hourly wages				
+ Missing data on employment specific controls	655	6,773	4,485	36,294
+ Missing data on outcome	1,021	5,752	5,112	31,182
+ Outlier deletion	112	5,640	619	30,563
+ <i>Less than two consecutive waves</i>			7,509	23,054

Source: Own calculations using NEPS (SC6), Waves 3–7, version 7.0.0, doi:10.5157/NEPS:SC6:7.0.0.

Table B1. Effects of control variables from Table 3

	1	2	3	4	5	6
Education (Reference = Low)						
Medium		–0.009 (0.02)			0.053*** (0.01)	
High		0.097*** (0.02)			0.062*** (0.01)	
Female		–0.227*** (0.01)			–0.012* (0.00)	
Migration status (Reference = Native)						
First gen.		–0.002 (0.02)			–0.012 (0.01)	
Second gen.		0.010 (0.02)			0.005 (0.01)	
Parents' education (Reference = Low)						
Medium		0.012 (0.01)			–0.007 (0.01)	
High		–0.014 (0.01)			–0.011 (0.01)	
Health (Reference = Good)						
Average		–0.052*** (0.01)	–0.005 (0.01)		–0.046*** (0.01)	–0.011*** (0.00)
Poor		–0.078* (0.03)	–0.023 (0.01)		–0.181*** (0.02)	–0.034*** (0.01)
Age		0.045*** (0.01)	0.051*** (0.01)		0.012*** (0.00)	0.009* (0.00)
Age ²		–0.000*** (0.00)	–0.000*** (0.00)		–0.000*** (0.00)	–0.000*** (0.00)

(continued)

Table B1. Continued

	1	2	3	4	5	6
Non-form. Learning		0.052*** (0.01)	-0.005 (0.01)		0.027*** (0.00)	-0.008** (0.00)
Children		0.050*** (0.01)	0.006 (0.01)		0.015** (0.01)	-0.003 (0.00)
ISEI		0.010*** (0.00)	0.004*** (0.00)			
Firm size (Reference = <10)						
<100		0.103*** (0.01)	0.036** (0.01)			
≥100		0.305*** (0.01)	0.056** (0.02)			
Change employer		-0.104*** (0.02)	0.020** (0.01)			
Wave (Reference = 10/11)						
11/12			0.026*** (0.01)			0.006* (0.00)
12/13			0.055*** (0.01)			0.008 (0.00)
13/14			0.078*** (0.01)			0.009 (0.01)
14/15			0.085*** (0.02)			0.009 (0.01)
Constant	2.745*** (0.01)	3.172*** (0.15)	3.633*** (0.16)	0.940*** (0.00)	1.213*** (0.08)	1.241*** (0.08)