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Article

The Interplay between Education, Skills, and Job Quality

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Abstract
Compared to general education, vocational education and training (VET) has been shown to facilitate young people's integration into the labour market. At the same time, research suggests that VET falls short in teaching basic skills and, in turn, may lead to less adaptability to labour market changes and long-term disadvantages in individual labour market outcomes. To better understand the relationships between education, skills, and labour market outcomes, we examine to what extent job quality differs between individuals with general education and those with VET with respect to different skill levels. Furthermore, we investigate whether the relationship between type of qualification and job quality differs by skills. We broaden past research by considering four indicators of job quality: earnings, job security, job autonomy, and the match between respondents' abilities and job demands. Using data from the Programme for the International Assessment of Adult Competencies for Germany, we demonstrate that individuals with academic education and advanced VET score higher in job quality concerning earnings and job autonomy as compared to individuals with initial VET. Comparing the two higher qualified groups, academic education is more associated with higher earnings than advanced VET, while the level of job autonomy is similar. Regarding the abilities-demands match, both groups score lower than individuals with initial VET. Moreover, higher literacy skills are associated with higher levels of job quality irrespective of the type and level of formal qualification. Finally, we find no empirical evidence that skills compensate for or reinforce disadvantages in job quality derived from professional qualifications.

Keywords
adult competencies; dual training system; general education; Germany; job autonomy; job quality; job security; literacy skills; Programme for the International Assessment of Adult Competencies; vocational education and training

Issue
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1. Introduction

In the era of digitalisation and knowledge-based societies, strategies to promote high skills are pursued to enhance a country's productivity and competitiveness. Key measures include broadening and raising the share of academic qualifications as well as promoting lifelong learning to increase the overall skills of the adult population. Concurrently, vocational education and training (VET) and equipping the workforce with work-specific skills play a key role in educational policies. In the Riga Conclusions of 2015 (European Commission, 2015), strengthening and modernising the vocational training system remains a priority of the European skills agenda, not least to support social inclusion by promoting the upskilling of the adult population and labour market inclusion of young people and groups disadvantaged on the labour market like migrant or unskilled workers.

This policy connects to studies that have shown that VET facilitates school-to-work transition and results in low rates of youth unemployment (Bol & van de Werfhorst, 2013; Forster, Bol, & van de Werfhorst, 2016; Müller & Shavit, 1998). At the same time, the advantage of VET relative to general education changes over the course of a working life and varies between national contexts, dynamics of the economy, and education and labour market systems (Brunello & Rocco, 2015; Hanushek, Schwerdt, Woessmann, & Zhang, 2017; Levels, van der Velden, & Di Stasio, 2014). One reason for the diminishing advantage of VET in relation to general education over the life-course may be that VET fosters work-specific skills, but compared to general education, it falls short in teaching basic skills such as literacy, numeracy, and problem-solving skills. This may lead to less adaptability to labour market changes and, hence, long-term disadvantages in individual labour market outcomes. While these basic skills have been shown to affect labour market outcomes, in particular wage returns and employment rates (Green & Riddell, 2015; Koutná & Janícko, 2018; McIntosh & Vignoles, 2001), it is as yet unclear whether they impact labour market outcomes over and above the type of professional education.

Moreover, generating income is not the only property of a job. Job security, rewarding relationships with colleagues and management, job autonomy, and having control over one's job tasks are examples of other job quality facets that have been shown to impact job motivation, job satisfaction, productivity, and turnover rates. As basic skills have become ubiquitous in today's society (McIntosh & Vignoles, 2001), we can expect that these skills affect not only earnings, but also other job quality characteristics. If the lack of basic skills is the reason for disadvantages in individual labour market outcomes, improving these skills should also be reflected in higher job quality.

Our research question focuses on whether job quality differs between individuals with general education and those with VET with respect to their different skill levels. Thereby, our contribution to past research is threefold: First, we expand the concept of job quality from earnings to additional labour market outcome variables, namely job security, job autonomy, and the presence (or absence) of a match between job demands and personal abilities. Second, we investigate whether basic skills (operationalised as literacy skills) have an impact on these job quality indicators over and above the level and type of formal qualification. And third, we look at whether well-developed literacy skills can compensate for, or rather reinforce, disadvantages in terms of job quality derived from formal qualifications. In our study, we focus on Germany where the vocational track has traditionally been strong and continues to play a prominent role in the education and labour market system.

We start with contextualising the role of VET in Germany against general education (Section 2). From here we introduce past research and delineate our research questions (Section 3). In Section 4, we specify our sampling approach, data, and variables. Our results, which we present in Section 5, are organised along the models we ran for each job quality indicator.

2. Country Context

Throughout all Organisation for Economic Co-operation and Development (OECD) countries, academic qualifications and higher education (i.e., tertiary education at universities, polytechnics, and universities of applied sciences or in vocational tracks) are of growing importance. Between 2000 and 2017, the share of younger adults with tertiary education (the 24–35 years age group) reached an OECD average of 44%, presenting an increase by more than 19% (OECD, 2018). With 31% and an increase of less than 14% over the same period, Germany remains at the lower end (OECD, 2018). This may be due to the competitive position of the German VET system, which continues to uphold a key role for economic prosperity and social mobility, even under conditions of globalisation, welfare state restructuring, demographic shifts, and economic crises. In Germany, well-developed vocational skills still ensure a smooth school-to-work transition (Müller & Shavit, 1998), low rates of youth unemployment (OECD, 2018), and stable employment and career progression (OECD, 2012).

The German system, based on highly standardised and stratified educational and occupational routes, ensures the tight coupling between skill formation and occupational labour markets (Allmendinger, 1989; Greinert, 2007; Rubery & Grimshaw, 2003), which is crucial for the process of job allocation. Employers can expect specific skills based on certificates that are standardised across schools, training programmes, and federal states. At the same time, individuals can expect that their investments in specific skills will pay off as educational and vocational routes are organised along linearity and upward mobility. The attendance of continuing education enhances future career perspectives, typically linked to higher income. For VET, the principle of linearity is reflected in the German *Meister* and *Techniker* advanced vocational qualifications, recognised (since 2014) as equivalent to a bachelor's degree in the German and European Qualifications Framework (EQF). While the *Meister* qualification supports job mobility, it may also be pursued to move into self-employment as it is a precondition in many areas and crafts to establish one's own business. This route, however, is not further considered in our study due to the assumed different notion of job quality associated with self-employment.

Stratified educational and occupational routes are also anchored in the German school system, which prepares pupils as early as at the age of ten (or twelve in some federal states) to either pursue a vocational track (with graduation after grade 9 or 10) or an academic track to obtain university entry qualification (*Abitur* after grade 12 or 13). Changing between the different school

types is possible, but not very common, particularly as concerns moving into higher school tracks (Blossfeld, 2018). This institutional stratification makes the German school system rigid, resulting in early social stratification (Dustmann, 2004; Schindler & Reimer, 2010). Early tracking furthermore restricts subsequent educational and career choices as well as job flexibility among the workforce (Glaesser, 2008; Solga, 2008).

3. Theoretical Framework and Research Questions

Investigating the relationship between education, skills, and job quality connects to theories of labour market returns on education. Traditional human capital theory assumes that higher investments in education yield higher productivity, which is gratified by higher earnings (Becker & Chiswick, 1966). Measured by years of education, this assumption, however, does not shed light on the differentiation between general versus vocational education. When looking closer at investments in general as compared to vocational education, the relative position of advantages and disadvantages in terms of earnings and other job-related variables has been found to change over the lifecycle: comparing 11 countries using the Adult Literacy Survey (IALS)—a Programme for the International Assessment of Adult Competencies (PIAAC) prestudy—Hanushek et al. (2017) found a trade-off between general education relative to vocational education, with advantages in earnings turning from vocational to general education around age 30 and flattening off around age 50. These findings are supported by Hampf and Woessmann (2017) who compare 16 countries using the PIAAC data. Both studies apply a difference-in-difference approach to compare labour-market outcomes (income, employment rate) across different age cohorts for male respondents with general and vocational education.

Apart from earnings (or income) as one important returns-on-education indicator, concepts of job quality include work organisation, job security, job flexibility, and employee participation, among other possible indicators (Holman, 2013). Trade-offs between general versus vocational education were also found for job security, one indicator of job quality we look at: While investments in specific human capital are considered to generate higher job stability particularly at early career stages due to their closer linkage to job requirements (Gervais, Livshits, & Meh, 2008), they are also considered riskier because specific human capital limits individuals' job flexibility and adaptation capacity to changing work tasks, technologies, or service demands. Hence, vocational education may increase the risk of unemployment or wage losses with age (Forster et al., 2016), particularly under conditions of rapid technological change or economic instability (Hanushek et al., 2017).

Signalling theory (Spence, 1973) provides an alternative explanation for the relationship between education and labour market outcomes. Modelling job allocation as an investment decision under uncertainty, observable characteristics such as certificates, educational degrees, or previous work experience serve as a symbol or signal for employers by providing information on the individual's job-related competence and productivity. In turn, individuals invest in signal adjustments (e.g., through education and training) as long as they can expect adequate returns to these investments. Studies have found that in countries with high degrees of external differentiation (i.e., tracking), educational certificates send a stronger signal about an individual's skills than in countries with low external differentiation. Consequently, in the former case, formal qualifications play a stronger role for success on the labour market (Andersen & Van De Werfhorst, 2010; Gesthuizen, Solga, & Kunster, 2011; Solga, 2008).

While the analysis of life-course effects is not within the scope of our article, these theoretical approaches guide us in developing our first two research questions: (1) To what extent does job quality differ between individuals who have completed general education and those who have completed a vocational qualification? (2) Does job quality also differ with respect to their different skill levels?

For Germany, signalling theory suggests that degrees are associated with higher job quality as external differentiation is marked. Furthermore, human capital theory suggests that general education yields higher job quality than vocational education because of higher job flexibility and the capacity to adapt to changing work requirements, which lowers the risk of unemployment or wage losses. Although being categorised as an "apprenticeship country", Hanushek et al. (2017) found that higher earnings for individuals with general education were particularly marked in Germany. This is explained by the fast technological development Germany has been undergoing, which is assumed to disadvantage skilled workers when they become older due to their limited capacities to adapt.

Both human capital and signalling theories fall short in explaining the impact of skills on job quality. While formal education confers credentials in form of years successfully completed and certificates obtained, uncertainty remains about the actual skills individuals have acquired or possess (Hunter & McKenzie Leiper, 1993) and how they affect labour market outcomes. This refers to occupation-specific skills (Eggenberger, Rinawi, & Backes-Gellner, 2018; Forster & Bol, 2018; Kracke, Reichelt, & Vicari, 2018) as well as basic skills commonly assessed as literacy, numeracy, and problem-solving skills (Heisig & Solga, 2015; Zabal et al., 2014). The complexity of work processes, automation, and the decentralisation of decision-making of today's working life lead to growing skill demands across all sectors so that the possession of basic skills can be considered a prerequisite to perform in the labour market (OECD, 2013). The question is how relevant they are as compared to formal qualifications when it comes to job quality. Basic skills have been shown to affect wage outcomes and employment rates (Koutná & Janícko, 2018; McIntosh

& Vignoles, 2001). Based on Canadian data, Green and Riddell (2015) showed that the effect of basic skills on earnings is substantial: in their analyses, a 25-point increase in literacy and numeracy skills (half of a standard deviation) was associated with an increase in earnings equivalent to an additional year of schooling, while one extra year of schooling raised average basic skills by 4.5 to 6%. Work experience, by contrast, had little impact on basic skills, which means that the positive relationship between work experience and earnings arises for other reasons. This shows that basic skills are largely obtained and signalled through formal education and have significant causal effects on labour market success. However, they also have their own independent effect that cannot be explained by schooling (Green & Riddell, 2015; OECD, 2016). While basic skills are also acquired in other contexts than schooling and through lifelong learning as practice engagement theory posits (Massing & Schneider, 2017; Reder, 1994), they are obviously highly recognised by employers.

This means that it is possible that basic skills can compensate for the lack of formal qualification, thus reducing differences in job quality between educational levels. Alternatively, basic skills may widen the job quality gap between different educational levels and qualifications if the opportunities or motivation to acquire these skills correlate with the type of education or if employers reward the combination of formal qualification *and* skills. These considerations lead us to look at the potential interaction between formal education and basic skills and ask: (3) Does the relationship between the type of qualification and job quality vary by skill level?

4. Data and Variables

4.1. Data

We use German large-scale data from the first wave of the PIAAC study conducted in 2012, which comprises a representative sample of 5,465 individuals. PIAAC was initiated by the OECD to provide internationally comparative measures of the skills of the working-age population between 16 and 65 years old (OECD, 2013). In particular, three basic skills are assessed: literacy, numeracy, and problem-solving skills in technology-rich environments. As all three basic skills highly correlate (.7 or higher), we use only literacy for our analyses. Literacy is commonly understood as the most basic of the three skill types (Massing & Schneider, 2017).

Our sample size varies by outcome variable from 2,084 for "earnings" to 2,217 for our "abilities-demands match", due to the different numbers of missing cases for the respective job quality indicator. For our samples, we considered employees who had completed a general or vocational qualification, who showed valid literacy measures, and who were not self-employed. We excluded self-employed individuals, assuming that job quality may be contextualised differently for self-employment and depended employment, which may produce incomparable results.

4.2. Variables

Our dependent variables are four indicators of job quality. *Earnings* is a generated variable defined as gross hourly earnings. We use hourly earnings in Euros to be able to study earnings of full- as well as part-time workers, including bonuses. Earnings are logarithmised to approximate a normal distribution, as the distribution of income is normally skewed to the right, and to prevent potential outliers from becoming too influential. Using logarithmised earnings, our (unstandardized) regression coefficients for earnings can be interpreted as percentage changes of wages. *Job security* is measured by differentiating between permanent and temporary contracts, associating a permanent contract with higher job security. *Job autonomy* is an index variable measured by individuals' self-assessed impact on task sequence, work performance, and working speed/rate. The original questions are: "To what extent can you choose or change the sequence of your tasks; how you do your work; the speed or rate at which you work?" Answers are coded in five categories ranging from one ("not at all") to five ("to a very high extent"). The results of a principal component analysis showed that these items capture one single latent dimension; the rotated factor loadings were all around .8. We use the factor values to measure job autonomy. Finally, we consider a variable assessing employees' perception of whether they need further training in order to cope well with their current duties. This is a binary variable ("yes"/"no") that we labelled *abilities-demands match*. Notably, while PIAAC provides a generated measure of vertical and horizontal skills mismatch, the applicability of this measure is strongly questioned, particularly for Germany (Rammstedt et al., 2013, 223–225). We thus refrained from using this generated measure.

Our main independent variables are *education* and *skills*. We measure respondents' professional qualification by their highest vocational or university degree, harmonised into a common scheme based on the International Standard Classification of Education (ISCED) of 1997 (UNESCO Institute for Statistics, 2006). To differentiate between general and vocational education, we generate three groups: ISCED level 3 (referred to as "initial vocational education" or "initial VET") includes employees who have completed a vocational training leading to skilled worker level (*Facharbeiter* or *Fachangesteller*). ISCED level 3 also includes individuals with higher education entrance qualification, but who did not complete any other vocational or academic qualification. The proportion of this group cannot be identified in the data, but for Germany it is smaller than 10% (Federal Statistical Office, 2018). We differentiate between two further groups, both categorised as ISCED level 5: individuals who have completed an advanced occupation-specific qualification, e.g., the German *Meister* qualifi-

cation or equivalent (categorised at ISCED level 5B and referred to as "advanced vocational education" or "advanced VET"); and individuals who have completed a university or university of applied sciences degree, representing general education (categorised as ISCED level 5A and referred to as "academic qualification" in the following). The OECD defines ISCED levels 5A and 5B both as "tertiary education" or "higher education".

In PIAAC, *literacy skills* are objectively assessed and encompass the ability to understand, use, and interpret written texts, e.g., drug labels or newspaper articles (Rammstedt et al., 2013). Based on the data of all countries participating in PIAAC, the items were scaled using item response theory (IRT). They produced a score ranging from zero to 500 points with an average of 250 points and a standard deviation of 50 points.

PIAAC requires considering the IRT to account for uncertainty resulting from measuring only a subset of items per person, which represent their proficiency distribution (Von Davier, Gonzalez, & Mislevy, 2009). For each person, 10 plausible values are available (Zabal et al., 2014). For this purpose, we treat the plausible values for literacy skills as multiply imputed values. Furthermore, we use replication weights assigned to every respondent, which in Germany are based on the delete-one jackknife approach with 80 replicate weights (Perry, Helmschrott, Konradt, & Maehler, 2017).

Respondents' and their parents' school qualification, age, gender, migration status, and firm size are our control variables. Because it is possible that the relationships between levels of education, skills, and job quality are the result of the (self-)selection of graduates of lower levels of schooling into VET, we control for respondents' school tracks as well as their parents' educational background and include their highest school qualification at the time of the interview into our models. We distinguish between "general education grade 9 or below", "general education grade 10", and "vocational upper secondary or general higher education entrance qualification".

We use *age* as a proxy for worker's experience and seniority, which have been shown to be positively correlated with job quality (Mumford & Smith, 2004; Wright, 1978). However, as previous research has found that the impact of age is not linear (Desjardins & Warnke, 2012; Kirsch, Jungeblut, Jenkins, & Kolstad, 1993), we include age as linear and quadratic term into our models. In addition, we control for gender as women have shown to be disadvantaged compared to men in terms of wage, occupational status, and job promotions (Altonji & Blank, 1999; Blau & Kahn, 2017). This gender gap is particularly marked in Germany, not least due to the German VET system and its close coupling with the labour market and welfare system (Haasler, 2014; Haasler & Gottschall, 2015). To control for migration background, we differentiate between natives, first generation immigrants, and second generation immigrants based on information on the country of birth of the respondents' parents. A vast amount of research demonstrates that immigrants have a lower job quality than natives. Key explanatory factors are limited international transferability of human capital, discrimination, and incomplete assimilation (Aldashev, Gernandt, & Thomsen, 2008; Friedberg, 2000; Junankar & Mahuteau, 2004; Nielsen, Rosholm, Smith, & Husted, 2004). Finally, we include *firm size* as a control for workplace characteristics. In our multivariate analyses, we treat firm size as a numeric variable that can assume five values as can be seen in Table 1.

5. Results

Figures 1 and 2 illustrate the findings of our empirical analyses (our full regression models can be found in the Appendix, Tables A1 to A4). For easier interpretation, we standardised all metric dependent and independent variables to have a mean of zero and a standard deviation of one.

Figure 1 shows the unconditional relationships between qualification, skills, and job quality: an academic or advanced vocational education is associated with higher earnings and job autonomy, whereas job security does not depend on the type or level of qualification. For the fourth dimension, "abilities-demands match", we find that an advanced qualification, vocational or academic, is associated with a wider gap between abilities and job demands than initial vocational education. This means that employees without an advanced qualification expressed less need for further training.

More specifically: the earnings of employees with advanced vocational or academic education are, on average, .38 (advanced VET) and .64 (academic education) standard deviations higher than the income of employees with initial VET. This means that individuals with advanced VET have an earnings advantage of 18% over individuals with initial VET, and individuals with academic education earn 31% more. This can partly be explained by the fact that individuals with tertiary education spend more years in the educational system and thus receive higher returns on their educational investment. The results for job autonomy cannot be translated into an everyday measure as they are based on factor values, but they show the same picture: academic qualification (.32 standard deviations) as well as advanced VET (.23 standard deviations) are associated with higher job autonomy than initial VET. Regarding the matching of abilities and job demands, employees with advanced vocational or academic qualification are 2.5 (academic education) and 1.9 (advanced VET) times more likely to feel that they need further training to be able to do their job well than employees with initial VET. This latter finding could be explained by higher qualified employees being more likely to take on higher level responsibilities which require transversal, leadership, and social skills. These skills are typically acquired through further training, not formal training. Given this assumption, our results can be interpreted from three different perspectives.

Table 1. Summary statistics.

	Overall (mean/%)	Initial VET (mean/%)	Advanced VET (mean/%)	Academic (mean/%)
Dependent variables				
Income				
Hourly earnings incl. bonus in €	16.21	13.45	17.77	21.94
Job security				
Permanent contract (%)	84.05	83.13	87.81	83.74
Job autonomy				
Sequence of tasks (1–5)	3.66	3.52	3.83	3.86
How to do tasks (1–5)	3.78	3.67	3.96	3.93
Working speed (1–5)	3.68	3.63	3.77	3.73
Autonomy factor	0.01	−0.12	0.18	0.24
Abilities-demands match				
No training necessary task fulfilment (%)	51.83	60.32	42.00	38.04
Independent variables				
Literacy skills (0–500)	276.03	260.66	286.58	305.56
Gender (%)				
Female	47.67	48.34	47.86	45.98
Migration (%)				
German	82.76	81.39	85.23	84.38
1st generation migrant	6.98	7.34	8.16	5.34
2nd generation migrant	10.27	11.27	6.61	10.28
Age (in years)	42.68	42.49	43.49	42.61
Professional qualification (%)				
Initial VET	58.94	—	—	—
Advanced VET	16.23	—	—	—
Academic education	24.83	—	—	—
School qualification (%)				
General education grade 9 or below	28.09	46.66	15.14	0.00
General education grade 10	41.96	53.34	51.50	8.70
Vocational upper secondary or general higher education entrance qualification	29.96	0.00	33.36	91.30
Parental educational qualification (%)				
Low (ISCED 1, 2, and 3C short)	9.61	12.57	7.57	3.93
Medium (ISCED 3 [excluding 3C short] and 4)	58.16	67.55	54.32	38.38
High (ISCED 5 & 6)	32.23	19.88	38.11	57.70
Firm size (%)				
1 to 10 people	32.52	28.48	21.58	13.00
11 to 50 people	26.44	26.97	27.88	24.23
51 to 250 people	24.29	23.57	21.98	27.49
251 to 1000 people	15.06	12.72	17.31	19.14
More than 1000 people	10.70	8.26	11.25	16.14

First, employees with advanced education (vocational or academic) simply have a lower job quality (with respect to this dimension) than employees with initial vocational education. Higher level responsibilities at work that may include staff and managerial responsibilities open up the possibility of not being equipped with these skills, leading to employees feeling over-challenged. Second, *not* feeling the need for further training might be an indicator for having a job or employment situation that offers no opportunities for professional development. In this case, our indicator would not measure job quality but a *lack* of job quality. Third, employees with an advanced education might have a different conception of their jobs in that they consider continuously improving their skills as an integral part of their job. In this case, our indicator would not measure job quality, but different job conceptions. This perspective is supported by Gauly and Lechner (2019), who show that highly skilled workers are more inclined to participate in work-related training.

To determine which of the three perspectives most likely applies needs further data and analyses, but also depends on the definition of "job quality". If one considers *subjectively perceived* job quality, the third perspective is probably correct. From a more normative stand-

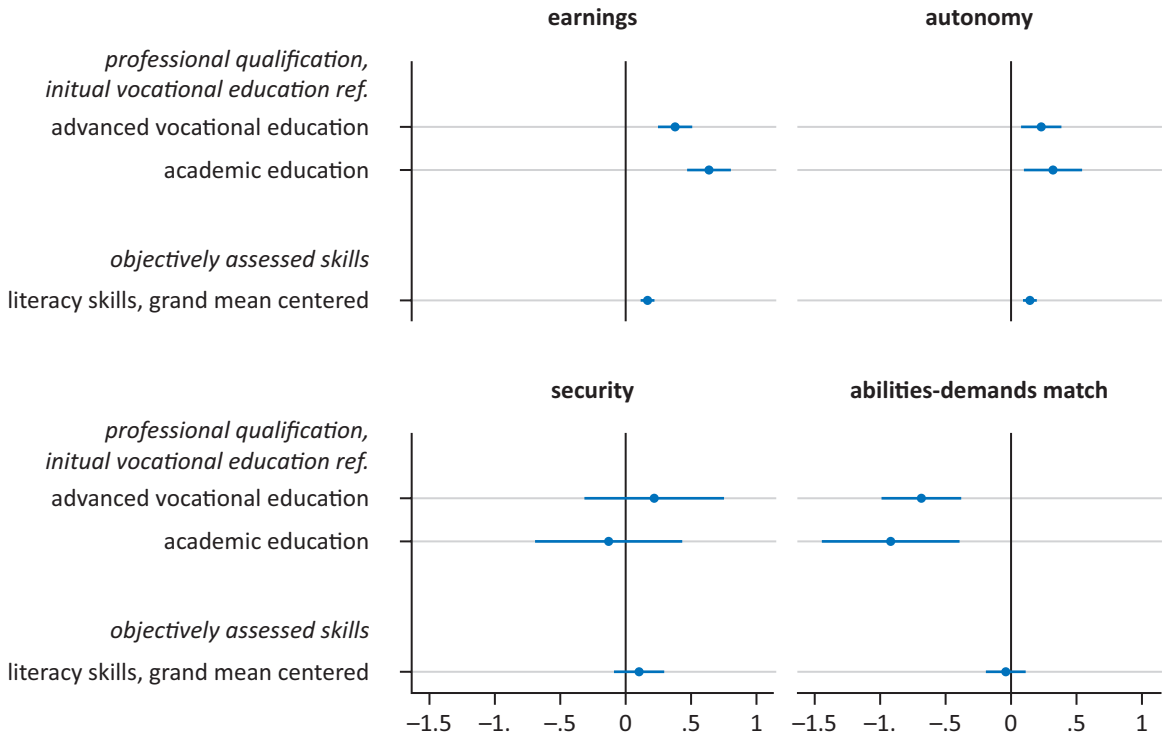

Figure 1. Associations of professional qualification and literacy skills with four indicators of job quality. Notes: PIACC 2012, continuous variables standardized; N(earnings) 2,084, N(autonomy) 2,216, N(security) 2,218, N(abilities-demands match) 2,217; the axis refers to either changes in S.D. (earnings and autonomy) or logits (security and abilities-demands match); controls: gender, migration, school qualification, age, age-squared, firm size, parental education.

point, job quality might be associated with how a job affects the individual's quality of life or opportunities for career development. If the quality of life is deemed decisive, and if the perceived need for further training is an indicator for being overstrained or feeling inadequate, our results may point to employees with advanced education having worse jobs than those with initial VET (with respect to this dimension of job quality). If opportunities to further one's career are being understood as an indicator of a good job, our results show that employees with an advanced education have better jobs.

Turning to our second research question, we find that literacy skills correlate with two dimensions of job quality, namely earnings and autonomy. For job security and the match between abilities and demands, the coefficients are not statistically significant. Since we use cross-sectional data, we cannot be sure whether literacy skills lead to jobs which are better paid and grant more autonomy, or whether well-paid jobs with a high level of autonomy imply tasks that enhance literacy skills, or both.

An argument in favour of the first perspective—literacy skills leading to better paid jobs with higher levels of job autonomy—is evidence that the number of years of work experience has little impact on enhancing literacy and numeracy skills (Green & Riddell, 2015). Against this, one could argue that not just working in general, but having a job that is cognitively demanding is decisive for improving one's basic skills. Such a job is more likely to require advanced vocational or academic education. Accordingly, studies have shown that a stimulating work environment facilitates using one's skills and learning by doing (Bynner & Parsons, 1998; Reder, 2009).

To answer our third research question, we included an interaction term between the level and type of education and literacy skills in model 2 (Figure 2). We wanted to find out whether literacy skills can compensate for a low level of formal qualification, or rather increase differences in job quality between individuals with different levels of qualification. Our results show that none of the interaction effects are statistically significant. It might be possible that both effects are decisive at the same time. Within the limits of our analyses, we cannot answer this question.

In conclusion, we found differences in job quality between employees with initial vocational education on the one hand, and those with advanced vocational or academic education on the other. These differences refer to two job quality dimensions, earnings and autonomy. Our results for the match between abilities and demands cannot be easily interpreted. For job security, measured by type of employment contract (i.e., permanent versus temporary), we found no differences between the three groups. This let us conclude that for the type of employment contract held, factors like age, gender, and sector may be more decisive than education. For example, temporary employment contracts are more common among young employees than older workers, and women are more affected than men. They are also much more used

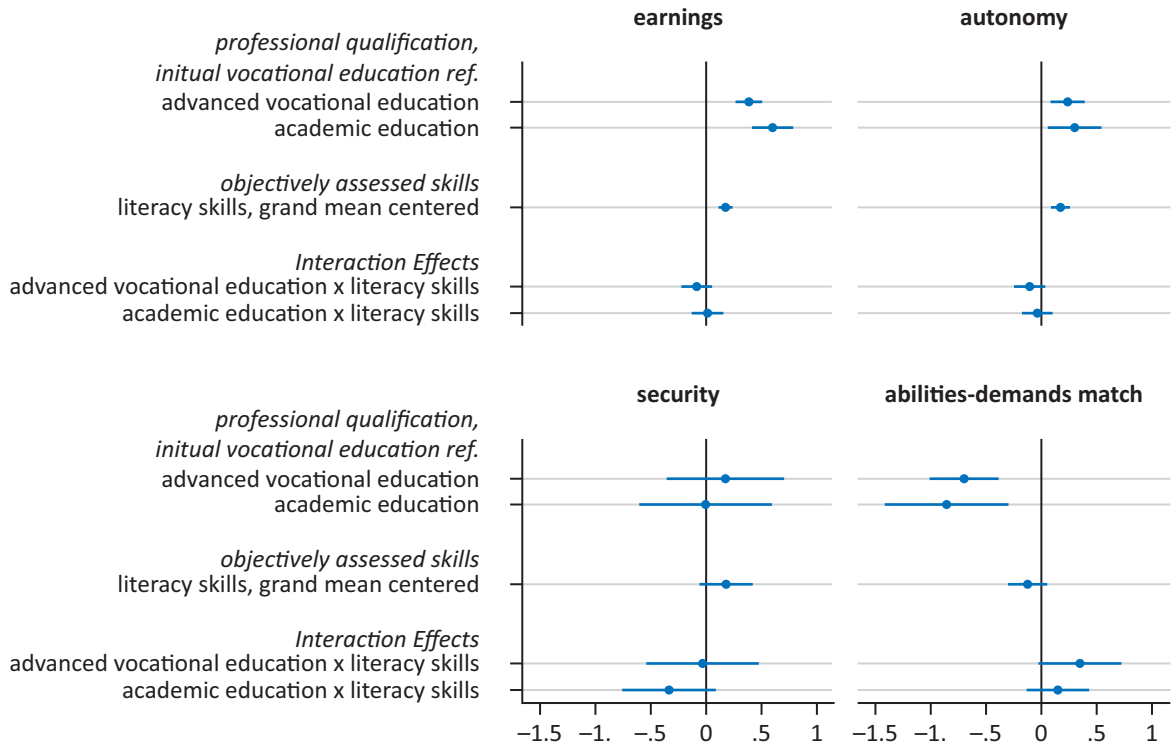

Figure 2. Associations of professional qualification and literacy skills and interactions between the two with four indicators of job quality. Notes: PIACC 2012, continuous variables standardized; N(earnings) 2,084, N(autonomy) 2,216, N(security) 2,218, N(abilities-demands match) 2,217; the axis refers to either changes in S.D. (earnings and autonomy) or logits (security and abilities-demands match); controls: gender, migration, school qualification, age, age-squared, firm size, parental education.

in the service sector (particularly in personal social services) than in industry (Haasler & Gottschall, 2015).

6. Conclusions

Our aim was to answer the question whether job quality differs between skills and types of professional education. In a second step, we wanted to shed light on the interaction between types of education and skill levels in impacting on job quality. Using the German PIAAC data, we could consider job security, job autonomy, and abilities-demands match as indicators of job quality in addition to earnings.

Our results show that employees with academic and advanced vocational qualification score higher in job quality with respect to earnings and job autonomy than individuals who have completed initial VET. Comparing the two higher-qualified groups, an academic education was associated with higher earnings than an advanced vocational qualification, while the level of job autonomy was similar for both groups and higher than for initial VET. Employees with academic or advanced vocational qualification more often expressed that they needed further training to cope with their job demands (abilities-demands match) than employees with initial VET. This result is difficult to interpret but may result from higher qualified employees assuming more responsible jobs and managerial tasks that require further training. Job security, by contrast, did not depend on the type or level of qualification.

With respect to literacy skills, our results showed that irrespective of the type and level of formal qualifications, basic literacy skills have an independent impact on job quality. This result is also supported by Hanushek et al. (2017), who find an incremental effect of literacy skills on income. Importantly, basic literacy skills are not solely the result of schooling but are also acquired in other contexts and through lifelong learning. Hence, the level of formal qualification either frames the opportunities and incentives to increase literacy skills, or employees are selected (or select themselves) into a career that enhances opportunities for increasing literacy skills, or both. We assume that both mechanisms may apply but leave this question to future research.

Our analyses lead to a double-sided conclusion: On the one hand, basic skills have shown to affect job quality irrespective of the level of qualification. On the other hand, skills and schooling are important for individual labour market outcomes; but for Germany, the level of professional qualification based on certificates is still decisive for job quality. This finding can be attributed to the highly formalised VET system and tight coupling between formal qualifications and the labour market system. The high scores for job quality for individuals with an advanced vocational qualification at *Meister* level reflects the strong position of the vocational track with es-

tablished career progression routes and protected employment. In this context, the possible impact and social inclusion effect of informal and lifelong learning, accreditation of prior learning, and similar measures to include disadvantaged groups into the labour market may potentially be rather weak.

Our study certainly has limitations. First, neither the data nor our analytical model allow for analysing causal effects. Rather, we make conclusions on relationships between education, skills, and job quality and derive possible explanations. Second, we cannot detail which specific skills could enhance job quality. Specifying literacy, numeracy, and problem-solving skills (which in PIAAC highly correlate), or occupation-specific skills acquired in general versus vocational education, may lead to differentiated results. Third, our categorisation of professional qualification may not adequately represent the actual skills acquired in a particular educational programme (Eggenberger et al., 2018), which may vary in their degree of occupational specificity (Forster & Bol, 2018). Fourth, our findings apply only to dependently employed and not to self-employed individuals. Fifth, the PIAAC data does not allow for completely ruling out potential selection effects. Still, our study introduces new perspectives on the relationships and interactions between skills, education, and labour market outcomes, in particular through considering different dimensions of job quality and providing insight into the specific role of advanced vocational qualifications on job quality in Germany.

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Conflict of Interests

The authors declare no conflict of interests.

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Appendix

Table A1. Full regression results for hourly earnings.

	Model 1			Model 2		
	exp(b)	se		exp(b)	se	
Gender (Male = Ref.)						
Female	−.30	.04	***	−.30	.04	***
Age	1.17	.14	***	1.17	.14	***
Age-squared	−.97	.14	***	−.98	.14	***
Migration status (Native = Ref.)						
1st generation migrant	.14	.06		.14	.07	
2nd generation migrant	−.12	.06		−.12	.06	
Professional qualification (Initial VET = Ref.)						
Advanced VET	.38	.05	***	.39	.06	***
Academic education	.64	.08	***	.60	.09	***
Literacy skills	.17	.02	***	.18	.03	***
School qualification (Higher education = Ref.)						
General education I (≤ grade 9)	.02	.08		.00	.07	
General education II (= grade 10)	−.02	.07		−.03	.09	
Parental educational qualification (Medium (ISCED 3 [excl. 3C short] and 4) = Ref.)						
Low [ISCED 1, 2, and 3C short	.00	.06		.00	.06	
High (ISCED 5 & 6)	−.02	.04		−.01	.04	
Firm size	.33	.02	***	.33	.02	***
Interactions						
Advanced VET*literacy				−.08	.07	
Academic education*literacy				.02	07	
Constant	−.08	.08		−.06	.09	
Number of observations	2,084			2,084		
Population size	20,683,806			20,683,806		

Notes: *** p < .001, ** p < .01, *p < .05; continuous variables standardized. Estimation with sample design weights. Cluster-robust standard errors with correction for the 10 plausible values of literacy skills.

Table A2. Full regression results for job autonomy.

	Model 1			Model 2		
	exp(b)	se		exp(b)	se	
Gender (Male = Ref.)						
Female	−.07	.04		−.07	.04	
Age	.12	.18		.13	.18	
Age-squared	−.02	.19		−.04	.19	
Migration status (Native = Ref.)						
1st generation migrant	.03	.10		.03	.10	
2nd generation migrant	−.42	.09	***	−.42	.09	***
Professional qualification (Initial VET = Ref.)						
Advanced VET	.23	.08	**	.24	.07	**
Academic education	.32	.11	**	.30	.12	**
Literacy skills	.15	.03	***			
School qualification (Higher education = Ref.)						
General education I (≤ grade 9)	.14	.13		.12	.13	
General education II (= grade 10)	.12	.11		.10	.11	
Parental educational qualification (Medium (ISCED 3 [excl. 3C short] and 4) = Ref.)						
Low [ISCED 1, 2, and 3C short	−.05	.07		−.05	.08	
High (ISCED 5 & 6)	.08	.05		.08	.05	
Firm size	−.05	.02	*	−.06	.03	*
Interactions						
Advanced VET*literacy				−.11	.07	
Academic education*literacy				−.04	.07	
Constant	−.14	.11		−.11	.12	
Number of observations	2,216			2,216		
Population size	22,012,599			22,012,599		

Notes: *** p < .001, ** p < .01, *p < .05; continuous variables standardized. Estimation with sample design weights. Cluster-robust standard errors with correction for the 10 plausible values of literacy skills.

Table A3. Full regression results for job security, logit coefficients.

	Model 1			Model 2		
	exp(b)	se		exp(b)	se	
Gender (Male = Ref.)						
Female	−.32	.14	*	−.33	.14	*
Age	3.00	.49	***	3.03	.50	***
Age-squared	−2.60	.51	***	−2.65	.52	***
Migration status (Native = Ref.)						
1st generation migrant	.37	.29		.38	.29	
2nd generation migrant	−.10	.20		−.11	.20	
Professional qualification (Initial VET = Ref.)						
Advanced VET	.22	.27		.18	.27	
Academic education	−.13	.28		−.01	.30	
Literacy skills	.10	.10		.18	.12	
School qualification (Higher education = Ref.)						
General education I (≤ grade 9)	.15	.31		.16	.31	
General education II (= grade 10)	.22	.25		.17	.25	
Parental educational qualification (Medium (ISCED 3 [excl. 3C short] and 4) = Ref.)						
Low [ISCED 1, 2, and 3C short	−.35	.25		−.35	.26	
High (ISCED 5 & 6)	.19	.14		.20	.15	
Firm size	.12	.06		.13	.07	
Interactions						
Advanced VET*literacy				−.03	.26	
Academic education*literacy				−.34	.21	
Constant	1.73	.30	***	1.78	.31	***
Number of observations	2,218			2,218		
Population size	21,975,517			21,975,517		

Notes: *** p < .001, ** p < .01, *p < .05; continuous variables standardized. Estimation with sample design weights. Cluster-robust standard errors with correction for the 10 plausible values of literacy skills.

Table A4. Full regression results for abilities-demands match, logit coefficients.

	Model 1			Model 2		
	exp(b)	se		exp(b)	se	
Gender (Male = Ref.)						
Female	−.07	.08		−.06	.08	
Age	−1.07	.36	**	−1.11	.36	**
Age-squared	1.31	.36	**	1.35	.37	***
Migration status (Native = Ref.)						
1st generation migrant	−.33	.18		−.33	.18	
2nd generation migrant	.37	.20		.38	.20	
Professional qualification (Initial VET = Ref.)						
Advanced VET	−.68	.15	***	−.70	.16	***
Academic education	−.92	.27	***	−.86	.28	**
Literacy skills	−.04	.08		−.13	.09	
School qualification (Higher education = Ref.)						
General education I (≤ grade 9)	−.02	.29		.04	.28	
General education II (= grade 10)	−.29	.24		−.23	.24	
Parental educational qualification (Medium (ISCED 3 [excl. 3C short] and 4) = Ref.)						
Low [ISCED 1, 2, and 3C short	.15	.18		.15	.18	
High (ISCED 5 & 6)	−.10	.11		−.11	.11	
Firm size	−.07	.05		−.08	.05	
Interactions						
Advanced VET*literacy				.35	.19	
Academic education*literacy				.14	.14	
Constant	.60	.26	*	.50	.27	*
Number of observations	2,217			2,217		
Population size	22,018,324			22,018,324		

Notes: *** p < .001, ** p < .01, *p < .05; continuous variables standardized. Estimation with sample design weights. Cluster-robust standard errors with correction for the 10 plausible values of literacy skills.