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Skills and educational systems

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Introduction

How well individuals are prepared for their labor market entry and later occupational careers is highly dependent on both individuals' skill acquisition and the skill requirements of their jobs. Both skill supply and demand are shaped by national education systems: the former because education systems structure learning opportunities, and the latter because such systems structure the pool of the available labor force (e.g., Rauscher 2015). Conversely, economic factors and associated occupational structures influence national educational systems, as partly argued by the political economy literature (e.g., Busemeyer 2015). In this chapter, we focus on how education systems shape individuals' skills acquisition; however, such education-system "effects" are of course embedded in national variations in occupational structures, which impact the configuration of educational systems.

Our understanding of the acquisition of general skills (or competences) in primary and secondary education (until the end of compulsory education) and the inequalities therein have greatly been enhanced with the expansion of international large-scale student assessments since the mid-1990s and early 2000s, such as the Progress in International Reading Literacy Study (PIRLS), the Programme for International Student Assessment (PISA) and the Trends in International Mathematics and Science Study (TIMSS). Trends vary significantly between countries and over time; for example, we observe declining means of literacy proficiency in a number of European countries and a rising performance in Asian countries.

Research on skill formation and inequality in tertiary education is much less common and lacks good macrolevel indicators for institutional differences in higher education systems, which are comparable to the well-established indicators of education-system differences in (upper) secondary education (e.g., tracking/external differentiation, vocational orientation in upper-secondary

education, or standardization) developed by Bol and van de Werfhorst (2013). Moreover, tertiary education research focuses more on participation in (or access to) education and its returns and less on the skills acquired in these educational programs (e.g., Reimer and Jacob 2011). One important exception is the U.S. longitudinal study by Arum and Roksa (2011, 2014), which assessed gains in students' general skills (such as critical thinking, analytical reasoning, problem solving and writing skills) during college and found only meager gains.

Examining the overall importance of education systems for skill acquisition and skill inequalities requires going beyond participation in education before labor market entry and addressing cross-national differences in worker training and lifelong learning, on the one hand, and how educational certificates and related individuals' competences affect individuals' job placement, on the other. The latter influences not only returns to education (e.g., in terms of earnings or occupational status) but also the interplay of skill acquisition, maintenance, and loss over individuals' life courses (e.g., Zull 2006). Both lifelong and workplace learning have received less attention in education research. First, this is because, conceptually, adult learning occurs not only as a highly institutionalized process in educational institutions but also at the workplace; second, this is because, empirically, few existing (especially longitudinal) data sources include skill measures for adults. The International Adult Literacy Survey (IALS, administered between 1994 and 1998), the Adult Literacy and Life Skills Survey (ALL, 2003–2007) and especially the Survey of Adult Skills (PIAAC, Programme for the International Assessment of Adult Competencies, which started in 2012) have increased the available research on adults' competences and lifelong learning; however, they are only cross-sectional studies and only include measures for general competences (e.g., numeracy or literacy).

A still unresolved issue in education research is how to measure occupational skills that are learnt in educational institutions/programs (such as in vocational upper-secondary education and training or tertiary education). Some progress in assessing employees' skills has been achieved in labor market research by measuring skills used in the workplace. Examples are the so-called task-based approach (based on population surveys that examine which skills workers *use* in the workplace), comprehensive databases of worker attributes and job characteristics (such as the U.S.-based Occupational Information Network O*NET), or expert judgments of required skills of standardized job titles at the occupation level (such as the Dictionary of Occupational Titles (DOT)) (Handel 2017). The underlying assumption of these approaches is that only in-demand skills and properly exercised skills will be rewarded (Liu and Grusky 2013). Arguably, there might be discrepancies between the

skills required by the job and the set of skills that employees actually possess. Thus, although we know something about the distribution of (required and exercised) occupational skills, we still lack knowledge about the levels of occupational skills possessed (not only exercised) by adults and how much of these skills are learned in educational programs versus in the workplace.

Against this background, we start with a short discussion on schooling and skill acquisition, followed by some considerations of skill acquisition in postsecondary education and adult life. We then briefly review institutional approaches to the role of education in the economy and finally discuss the relationship between skills and educational degrees and how this relationship is influenced by educational systems. We conclude the chapter with some remarks on how the interplay between skills and education systems improves our understanding of labor market inequalities and provide some suggestions for future research.

Schooling as productive skill enhancement?

Throughout the education system, a major task of schooling is to foster various sorts of skills among students. In primary education, much attention is devoted to general skills such as reading and writing skills and mathematics, which are meant to build a foundation for further learning. In secondary education, the attention shifts to differentiation toward different “futures”, with students entering different tracks, streams or levels of schooling to prepare for either the labor market or further education. Upper-secondary vocational and postsecondary education, then, aims to develop more specific skills toward a work field.

Despite strong consensus about this core task of schooling, there is much debate about the extent to which educational institutions indeed generate skills. Obviously, there would be fewer reading, writing, mathematics, and other domain-specific skills in the absence of schooling. By comparing learning trajectories during school months and summer holiday months, research shows that more learning occurs in the school months than in the summer months, especially among less advantaged socioeconomic groups (Downey 2020). This line of research concludes that schools reduce inequality in skill acquisition caused by children’s social environment, relative to a counterfactual situation in which no schooling exists. A more critical literature comparing the skill distributions before schooling starts with the distributions throughout primary education in the U.S. shows that the *relative* position of students in these

distributions is very stable, and thus, the extent of the socioeconomic gaps in children's competences hardly changes during primary school (Bradbury et al. 2015). Similar results have been found for Germany (Passaretta and Skopek 2021; Skopek and Passaretta 2021). In contrast, socio-economic achievement gaps are smaller in Australia, Canada and the UK for different reasons (e.g., universal health insurance, universal preschool and additional school resources for students from disadvantaged families) (Bradbury et al. 2015). These country differences highlight that individuals' skill acquisition is influenced not only by the characteristics of education systems and families but also by societal conditions in which schooling and learning are embedded (Borgna et al. 2019).

Looking at how important skills are for economic growth (and are thus "productivity-enhancing"), some scholars have highlighted a stronger predictive power of (measured) general cognitive skills on economic growth and income distributions than of educational degrees or years of schooling (e.g., Checchi and van de Werfhorst 2018; Hanushek and Woessmann 2008). Hence, one may conclude that the improvement of students' skills is more important than educational expansion in terms of diplomas per se. Such an optimistic perspective on skill acquisition relates to classical structural-functionalist sociological theory, which argues that the production and reward of skills—rather than the premodern allocation on the basis of social origin—create an "efficient" sorting of individuals into the stratification order (Barone and van de Werfhorst 2011).

However, the idea that education produces productivity-enhancing *cognitive* skills is only one perspective on how education is related to labor market success and inequalities. Cognitive skills explain less than 20 percent of educational differentials in earnings and occupational status (Bowles and Gintis 2002; see also Barone and van de Werfhorst 2011; Heisig et al. 2019). So-called *noncognitive skills*, including traits that optimize employers' authority over workers and personality traits, have been shown to be influential as well (e.g., Borghans et al. 2008; Jackson 2006).¹ Additionally, the task-based approach illustrates the relevance of cognitive and noncognitive skills, as (cognitive) analytical and (non/cognitive) managerial skills are increasingly rewarded in the U.S. labor market (Liu and Grusky 2013). However, research on whether and how schools foster children's acquisition of noncognitive skills is still very rare. For a long time, personality traits were assumed to be stable and socially inherited (Goldthorpe 1996). Recent research demonstrates, however, that noncognitive skills are changeable and trainable (e.g., Bleidorn et al. 2019). This unsettled debate renders the role of various sorts of skills in the intergenerational mobility process as an urgent area of research.

Skill formation in (young) adult life

A substantial proportion of young adults continue their schooling with vocational education and training (VET) or higher education (HE) programs; later in life, they can engage in learning via adult training measures. Approximately half of the under-25-year-old individuals in advanced economies enter tertiary education and more than a third of them graduate before the age of 30 (OECD 2021: 190, 200). Moreover, approximately half of the 25- to 64-year-old individuals surveyed in the Adult Education Survey (AES) participated in formal and/or nonformal adult education and training in 2016 (OECD 2021: 134). These participation rates in tertiary education and adult training vary significantly across countries.

The questions of how postcompulsory education systems and the wider political economy structure young people's skill acquisition and labor market integration have received considerable attention in research. Societies differ in their relative balance toward generating occupation-specific or general skills (Bills and van de Werfhorst 2017; Hall and Soskice 2001; Maurice et al. 1986; Shavit and Müller 1998). This literature argues that the higher occupation specificity of postcompulsory education (i.e., educational programs with strong orientations of curricula toward the acquisition of specific vocational skills) immediately fosters productivity-enhancing and valuable skills for employers. This consideration applies not only to VET systems but also to HE systems (e.g., Leuze 2007; van de Werfhorst 2004).

This research consistently demonstrates that graduates in countries with more occupation-specific postcompulsory education systems transition not only faster into the labor market but also more often into jobs that match their formal qualifications. More recent research also highlights within-country differences in the matching of fields of VET or HE programs and jobs for a strong occupation-specific education system. The so-called linkage strength approach, which was developed by DiPrete et al. (2017), conceptualizes degrees (strength) of occupational specificity of educational programs by the linkage between educational programs and job placements; the degree is high when a large number of graduates from one VET or HE program (defined by level and field) cluster in a narrow set of occupations, and vice versa, it is weak when graduates are found to work in a large number of different occupations. For example, in all countries studied, health programs are highly occupation specific, while the linkage strength of business and administration programs is rather low (DiPrete et al. 2017).

Based on this linkage strength approach, research shows that the between-country differences in occupational specificity of educational systems reported in typology-based research are due to *compositional* differences in terms of fields of VET and HE programs rather than to differences in the *strength* of the association between program fields and job placement. Elbers et al. (2021) found that job placements of graduates from occupation-specific programs are similar in Germany and France, which are two countries known to have quite distinct skill equilibria. However, Germany has a much higher share of occupation-specific programs (in both the VET and HE systems) than France, which results in the aggregate-level, between-country differences observed in typology-based studies.

In recent years, there has been an ongoing debate about the advantages and disadvantages of acquiring occupation specific skills in young adulthood. The so-called vocational decline thesis by Hanushek et al. (2017) states that the advantages of vocational programs in smoothing school-to-work transitions reverse into a disadvantage across the working life because of a faster depreciation of vocational skills over the life course. This research relies again mainly on the simple differentiation between vocational and general types of education. This dichotomy has been criticized for not properly operationalizing the assumed underlying mechanism, namely, that “occupational specificity is indeed the main mechanism through which vocationally schooled graduates gain a benefit when entering the labor market and suffer a penalty in later life” (Forster and Bol 2018: 177).

Using the aforementioned linkage strength approach, Forster and Bol (2018) found for the Netherlands—a country with a rather high enrollment in VET programs—that the employment probabilities of graduates from highly specific programs are higher than those for graduates from less specific programs and that these differences only vanish after the age of 60. Moreover, Forster et al. (2016) demonstrated that the assumed vocational decline is not typically associated with systems with a strong vocational orientation. In contrast, the vocational decline in the later life course is particularly strong in more general-skills-oriented educational systems. Therefore, while Hanushek et al. (2017) interpreted the pattern of vocational decline as a risk of VET systems per se, the pattern is more likely to reflect individual differences in careers between educational groups.

Turning to adult education and training, research (across countries) consistently shows that participation in adult training exacerbates rather than mitigates educational disparities (see literature review in Bills and van de Werfhorst 2017). One reason for this finding is that job characteristics (e.g., job

tasks, type of work contract, firm size) are strong predictors of adult training participation (e.g., Ehlert 2020; Görlitz and Tamm 2016; Hornberg et al. 2021; Korpi and Tählin 2021; Schindler et al. 2011). Thus, the positive relationship between educational attainment and adult training participation is mediated by workers' job placements. It should be noted, however, that only the study by Hornberg et al. (2021) accounts for workers' skills, which is important as skills and job placements are strongly related (Heisig et al. 2019). Finally, very little is known about skills growth by means of adult training programs.

Institutional characteristics of education systems and skill formation

Societies differ significantly in how education is organized, and such differences are reflected in the types and distribution of skills found in societies. Initially, more from a social mobility than skills perspective, Turner (1960) differentiated between sponsored (i.e., socially reproductive) and contest (i.e., meritocratic) mobility regimes. Later contributions more evidently addressed skills, in particular those that consider the uniformity versus the differentiation of the skills obtained in the education system (e.g., Allmendinger 1989; Shavit and Müller 1998). Various dimensions of educational systems relate to uniformity versus differentiation of skills.

First, educational systems have been classified according to the extent and timing to which students are sorted into different skill trajectories (school tracks). Late-selecting educational systems (most of which start around the age of 16 and are thus present in upper-secondary education) have all reformed their selection rules over the course of the past 60 years (van de Werfhorst 2019). After compulsory education, and mostly starting with upper-secondary education, tracking then sorts students into academic and vocational tracks related to different sorts of skills (general versus occupational skills).

Seen from a skill perspective, early selection mostly relates to the speed and ultimate level of attainment of skills for different groups of students (Strello et al. 2021), while the existence of a strong VET sector more clearly indicates separate sorts of skills. Research suggests that early tracking is more clearly associated with larger inequalities in skills and educational degrees.

Although empirically associated with (early) tracking,² strong firm-based VET systems are more inclusive, as they help foster the occupation-specific skills of school leavers with *lower* school attainment and thereby improve their

chances of being employed in skilled jobs (Brunello and Checchi 2007; Heisig and Solga 2015; Shavit and Müller 1998). Strong VET systems “are relatively effective in mitigating skill inequality” (Green and Pensiero 2016: 761). For a large group of young people, such programs provide relatively standardized curricula (often also mandating mathematics or national language on all upper-secondary programs) and durations of training in both general competences and vocational skills, accompanied by relative parity of esteem between the different tracks. Moreover, a pioneering causal study using longitudinal survey data from Denmark suggested a positive impact on conscientiousness of vocational training participation but not of general upper-secondary education (Birkelund 2022).

Another uniformity-differentiation aspect of skill formation concerns the standardization of educational systems. Standardization can come in different forms; a common distinction is the standardization of input and of output. Input standardization concerns the standardization of schools’ resources to harmonize the educational process (e.g., school budgets, teacher education or curriculum standardization). It relates to the extent to which national or regional governments standardize the organization of learning processes or the idea that schools can make their own decisions in this regard (i.e., the extent of school autonomy). Research shows that input standardization negatively affects student learning, while school autonomy affects it positively (e.g., Checchi et al. 2014). Output standardization involves standardized means by which to assess student outcomes, such as standardized tests and examinations. Standardized examinations are associated with higher levels of performance and lower socioeconomic inequalities (Bishop 1999; Bol et al. 2014; Woessmann 2005). From a skills perspective, the standardization of input and output is likely to homogenize the skill level within categories of education. In the stratification literature, such homogenization is expected to strengthen the link between qualifications and labor market attainment, although support for this hypothesis is mixed at best (Levels et al. 2014; Shavit and Müller 1998).

Despite these clear differences between educational systems, it is also important to draw attention to the Stanford School of Institutionalism. Its basic idea is that there exists a tendency toward the uniformization of educational systems across modern societies (e.g., Schofer and Meyer 2005). Seen from a skills perspective, Meyer’s (1977) cultural “World Society” model emphasizes the rise of the focus on general skills serving the modernization of the state (e.g., in the fields of literacy, mathematics and history) and of national policies promoting educational expansion. Expansion and uniformization can be explained by a cultural theory of institutional change that posits that

educational institutions are adopted beyond what is necessary or functional for a particular society.

Institutional differences in the relationship between skills and educational certificates

Finally, we discuss how skills are related to educational degrees, how differences between education systems influence this relationship and the labor market values attached to skills and degrees as two dimensions of education. For a long time, only levels of formal qualification (educational certificates/degrees) were used in social mobility and labor market research. The various large-scale assessments of competences show that educational certificates or often-used years of education are not ideal proxies for skills because of the large skill heterogeneity present within educational groups (see, e.g., Heisig 2018; Heisig and Solga 2015). Because of this within-group heterogeneity and because skill formation processes (including losses) do not end with initial education, some scholars argue to use direct measures of skills instead of relying on educational credentials. For example, Vera-Toscano et al. (2017: 217) stated that “Whilst the formal education received is constant after exiting the educational system, skills reflect competences more accurately”. This corresponds to the discussion about the importance of skills versus educational degrees for economic growth (see Section 2). However, although an individual’s skills vary over the life course, only focusing on skills in later life and ignoring educational degrees would be throwing the baby out with the bathwater for several reasons.

First, research on lifelong learning has consistently demonstrated a strong positive association between educational degrees and training participation (see Section 3). In other words, later skill formation processes do not substitute but rather complement and increase inequality in early educational attainment.

Second, skills are not easily observable by employers, especially before hiring. Thus, educational certificates are not only proxies of skills in research but also serve as a “signal” of workers’ prospective productivity and training costs in real life (see Bills 2003). Correspondingly, research shows that job placement is highly dependent on educational certificates, even after accounting for workers’ actual skills (e.g., Araki 2020; Heisig et al. 2019). This research has also revealed that the signaling value or the “skill transparency” of educational certificates—that is, how informative formal qualifications are about individuals’ skills—varies by the characteristics of education systems (Andersen and van de Werfhorst 2010). For example, based on PIAAC data, research shows

that the skill transparency of educational degrees (operationalized as skill gaps between educational groups and skill homogeneity within educational groups) is higher in countries with stronger (ability-related) tracking systems (Heisig 2018; Heisig and Solga 2015).

Third, educational certificates constitute an “institutionalized bottleneck of skill supply”, especially in countries with high “reliance on credential-based recruitment” for jobs (Liu and Grusky 2013: 1335, 1339). Hence, above and beyond skills, educational certificates structure individuals’ job placement by defining who is “entitled” to what kind of job—also known as mechanisms of occupational closure (or opportunity hoarding; Tilly 1998; Tomaskovic-Devey and Avent-Holt 2019). The basic idea of opportunity hoarding is that organizations match organizationally external categories to internal categories to lower transaction costs for organizational tasks (such as hiring) and to increase organizational stability (Tilly 1998: 80f.). Educational certificates, which are provided by education systems and recognized as legitimate allocation criteria (Meyer 1977), are such external categories, as they are mirrored by educational requirements and job levels within firms. VET systems, such as the German firm-based VET system, are such an institutional bottleneck of skill supply, even though they are beneficial for individuals’ occupation-specific skill formation and smooth transitions into skilled jobs at labor market entry (e.g., Brzinsky-Fay and Solga 2016; Shavit and Müller 1998).

In sum, educational systems with strong tracking, strong vocational orientation in upper-secondary education, and more limited tertiary enrollment generate a higher skill transparency of educational degrees; because of this higher skill transparency, the countries who utilize such systems are also characterized by a stronger relationship between educational attainment and occupational status (Andersen and van de Werfhorst 2010; Heisig et al. 2019).

These different aspects indicate, in contrast to the abovementioned claim by Vera-Toscano et al. (2017), that the “allocative effect of educational attainment” (Liu and Grusky 2013: 1353) cannot be underestimated for both skill formation processes and labor market success over the life course. Educational qualifications are important for allocating individuals into jobs and occupations and thereby into different learning environments. We should rather continue to look at skills and educational qualifications as two well-established and equally important socially constructed dimensions of education that both impact individuals’ labor market opportunities, from both an empirical and a theoretical perspective. Even if skills are empirically more important than qualifications for economic growth and income distributions (Section 2), it is also true that qualifications maintain their legitimated signaling function,

thereby leading to formal and informal processes of inclusion and exclusion into further skill development and associated rewards.

Concluding remarks and outlook for future research

Our review of research on skills and education systems demonstrates that a better understanding of how educational systems influence skill acquisition contributes to our understanding of why skills—but also educational certificates above and beyond skills—are rewarded in labor markets.

While research on general (domain-specific) skills such as numeracy, literacy or science competences has grown in recent years, research on the skill *formation* of vocational skills and noncognitive skills is still rare. For the former, we mentioned the difficulty of measuring which occupation-specific skills have been learned in education and across the life course. Thus far, research is able to study occupation-specific skills that are used in and required by the workplace (however, they probably do not display all actual occupation-specific skills possessed by individuals).

Moreover, most of the skill literature focuses on skills that are directly productive for the economy. Other skills receive less attention, although they may be equally important for sustaining a society (and thus also labor markets), for the democratic involvement of citizens, or for the personal development necessary to simply flourish as human beings (Allen 2016; van de Werfhorst 2017). Furthermore, the skills needed to develop and work with information and communication technology (ICT) are understudied, especially in light of the ongoing technological changes; i.e., with artificial intelligence progressing with a rapidity unseen before.

The most urgent task to improve our knowledge of individuals' skill acquisition and maintenance is to develop longitudinal skills assessments over the entire educational and work career. First, with cross-sectional data and approaches, it is difficult to assess causal relationships between learning, skills, and outcomes. Second, the extent to which earlier skill formations impact later-life skill formations is not well understood. One possibility is that individuals with higher levels of skills obtained in initial education also generate more skill development in later life, thereby producing Matthew effects. However, another possibility is that educational systems (such as strong VET systems) support substituting a lack of skills produced in initial education with having firms invest more in their workers' skill development (Bills and van

de Werfhorst 2017; see also Section 3). For individual countries, longitudinal data have become more widely available; for example, through register data on examinations at various stages in the school career, such as in the Netherlands Cohort Study on Education (Haelermans et al. 2020), or through large-scale data projects, such as the German National Education Panel Study (NEPS; Blossfeld and Roßbach 2019), comparative longitudinal skill assessments are yet unseen but crucial to understanding how educational systems (and their connection to labor markets) foster skill formation over the life course.

Finally, existing research on returns to skills strongly relates to a meritocratic “human capital” explanation for inequalities. Alternative theories have been proposed that criticize a taken-for-granted optimal matching between skills and returns. As discussed above, the theoretical account of educational certificates as an institutional bottleneck or the relational perspective of inequality open the view on who is able to define the value of certain contributions (such as “skills”) to the organization (Tomaskovic-Devey and Avent-Holt 2019). The cultural sociological perspective on valuation also suggests paying more attention to the endogenous process of how the value of different skills is determined (Lamont 2012). As alternatives to the human capital perspective, these perspectives deserve further attention to develop a better understanding of the relevance of skills to labor markets.

Notes

1. Noncognitive skills refer to “patterns of thought, feelings, and behavior” (Borghans et al. 2008: 974). Despite ongoing discussions, we will use the term noncognitive skills in the interest of readability.
2. The country-level correlation between tracking and strength of the VET system is 0.48 (van de Werfhorst 2011).

References

- Allen, D. (2016). *Education and Equality*. Chicago: University of Chicago Press.
- Allmendinger, J. (1989). Educational systems and labor market outcomes. *European Sociological Review* 5, 231–250.
- Andersen, R., & van de Werfhorst, H.G. (2010). Education and occupational status in 14 countries. *The British Journal of Sociology* 61, 336–355.
- Araki, S. (2020). Educational expansion, skills diffusion, and the economic value of credentials and skills. *American Sociological Review* 85, 128–175.

- Arum, R., & Roksa, J. (2011). *Academically Adrift: Limited Learning on College Campuses*. Chicago: University of Chicago Press.
- Arum, R., & Roksa, J. (2014). *Aspiring Adults Adrift: Tentative Transitions of College Graduates*. Chicago: University of Chicago Press.
- Barone, C., & van de Werfhorst, H.G. (2011). Education, cognitive skills and earnings in comparative perspective. *International Sociology* 26(4), 483–502.
- Bills, D.B. (2003). Credentials, signals, and screens: Explaining the relationship between schooling and job assignment. *Review of Educational Research* 73, 441–449.
- Bills, D.B., & van de Werfhorst, H.G. (2017). Workplace training from the sociological perspective. In K. Brown (ed.), *The Cambridge Handbook of Workplace Training and Employee Development*. Cambridge: Cambridge University Press, pp. 626–644.
- Birkelund, J.F. (2022). Educational tracking and personality formation: Evidence from a dual system. *Social Forces* 100(4), 1696–1721.
- Bishop, J.H. (1999). Are national exit examinations important for educational efficiency? *Swedish Economic Policy Review* 6(2), 349–401.
- Bleidorn, W., Hill, P.L., Back, M.D., Denissen, J.J.A., Henneke, M., Hopwood, C.J., Jokela, M., Kandler, C., Lucas, R.E., Luhmann, M., Orth, U., Wagner, J., Wrzus, C., Zimmermann, J., & Roberts, B. (2019). The policy relevance of personality traits. *American Psychologist* 74(9), 1056–1067.
- Blossfeld, H.-P., & Roßbach, H.-G. (eds.) (2019). *Education as a Lifelong Process*. Edition ZfE (Zeitschrift für Erziehungswissenschaft), Vol. 3. Wiesbaden: Springer VS.
- Bol, T., & van de Werfhorst, H.G. (2013). Educational systems and the trade-off between labor market allocation and equality of educational opportunity. *Comparative Education Review* 57, 285–308.
- Bol, T., Witschge, J., van de Werfhorst, H.G., & Dronkers, J. (2014). Curricular tracking and central examinations. *Social Forces* 92(4), 1545–1572.
- Borghans, L., Duckworth, A.L., Heckman, J.J., & ter Weel, B. (2008). The economics and psychology of personality traits. *Journal of Human Resources* 43(4), 972–1059.
- Borgna, C., Brzinsky-Fay, C., Dieckhoff, M., Holtmann, A.C., & Solga, H. (2019). Beyond schools: The social embeddedness of educational inequality. In R. Becker (ed.), *Research Handbook on the Sociology of Education*. Cheltenham, UK and Northampton, MA, USA: Edward Elgar Publishing, pp. 575–590.
- Bowles, S., & Gintis, H. (2002). Schooling in capitalist America revisited. *Sociology of Education* 75(1), 1–18.
- Bradbury, B., Corak, M., Waldfogel, J., & Washbrook, E. (2015). *Too Many Children Left Behind: The U.S. Achievement Gap in Comparative Perspective*. New York: Russell Sage Foundation.
- Brunello, G., & Checchi, D. (2007). Does school tracking affect equality of opportunity? *Economic Policy* 22(52), 781–861.
- Brzinsky-Fay, C., & Solga, H. (2016). Compressed, postponed, or disadvantaged? School-to-work-transition patterns and early occupational attainment in West Germany. *Research in Social Stratification and Mobility* 46, 21–36.
- Busemeyer, M.R. (2015). *Skills and Inequality: Partisan Politics and the Political Economy of Education Reforms in Western Welfare States*. Cambridge: Cambridge University Press.
- Checchi, D., & van de Werfhorst, H.G. (2018). Policies, skills and earnings: How educational inequality affects earnings inequality. *Socio-Economic Review* 16(1), 137–160.
- Checchi, D., van de Werfhorst, H.G., Braga, M., & Meschi, E. (2014). The policy response to educational inequalities. In W. Salverda, B. Nolan, D. Checchi, I. Marx,

- A. McKnight, I. G. Toth & H.G. van de Werfhorst (eds.), *Changing Inequalities in Rich Countries*. Oxford: Oxford University Press, pp. 294–327.
- DiPrete, T.A., Bol, T., Ciocca Eller, C., & van de Werfhorst, H.G. (2017). School-to-work linkages in the United States, Germany, and France. *American Journal of Sociology* 122, 1869–1938.
- Downey, D.B. (2020). *How Schools Really Matter*. Chicago: University of Chicago Press.
- Ehlert, M. (2020). No future, no training? Explaining cross-national variation in the effect of job tasks on training participation. *Kölner Zeitschrift für Soziologie und Sozialpsychologie* 72, 483–510.
- Elbers, B., Bol, T., & DiPrete, T.A. (2021). Training regimes and skill formation in France and Germany. *Social Forces* 99(3), 1113–1132.
- Forster, A.G., & Bol, T. (2018). Vocational education and employment over the life course using a new measure of occupational specificity. *Social Science Research* 70, 176–197.
- Forster, A.G., Bol, T., & van de Werfhorst, H.G. (2016). Vocational education and employment over the life cycle. *Sociological Science* 3, 473–494.
- Goldthorpe, J.H. (1996). Problems of “meritocracy.” In R. Erikson & J.O. Jonsson (eds.), *Can Education Be Equalized?* Boulder, CO: Westview Press, pp. 255–287.
- Görlitz, K., & Tamm, M. (2016). Revisiting the complementarity between education and training: The role of job tasks and firm effects. *Education Economics* 24, 261–279.
- Green, A. & Pensiero, N. (2016). The effects of upper-secondary education and training systems on skills inequality. *British Educational Research Journal* 42, 756–779.
- Haelermans, C., Huijgen, T., Jacobs, M., Levels, M., van der Velden, R., van Vugt, L., & van Wetten, S. (2020). Using data to advance educational research, policy, and practice: Design, content, and research potential of the Netherlands Cohort Study on Education. *European Sociological Review* 36(4), 643–662.
- Hall, P.A., & Soskice, D. (2001). *Varieties of Capitalism*. Oxford: Oxford University Press.
- Handel, M.J. (2017). Measuring job content: skills, technology, and management practices. In J. Buchanan, D. Finegold, K. Mayhew & C. Warhurst (eds.), *The Oxford Handbook of Skills and Training*. Oxford: Oxford University Press. (Online handbook, DOI: 10.1093/oxfordhb/9780199655366.013.5.)
- Hanushek, E.A., & Woessmann, L. (2008). The role of cognitive skills in economic development. *Journal of Economic Literature* 46(3), 607–668.
- Hanushek, E.A., Schwerdt, G., Woessmann, L., & Zhang, L. (2017). General education, vocational education, and labor-market outcomes over the lifecycle. *Journal of Human Resources* 52(1), 48–87.
- Heisig, J.P. (2018). Measuring the signaling value of educational degrees. *Large-scale Assessments in Education* 6, no. 9.
- Heisig, J.P., & Solga, H. (2015). Secondary education systems and the general skills of less- and intermediate-educated adults. *Sociology of Education* 88, 202–225.
- Heisig, J.P., Gesthuizen, M., & Solga, H. (2019). Lack of skills or formal qualifications? New evidence on cross-country differences in the labor market disadvantage of less-educated adults. *Social Science Research* 83, no. 102314.
- Hornberg, C., Solga, H., & Heisig, J.P. (2021). Chapter 3: Training opportunities of less-skilled adults in international comparison. In *Technequality Deliverable 3.6: Analysing Determinants of Participation in Adult Education and Learning* (EU Ref. Ares(2021)8018847-31/12/202), pp. 54–103 (retrieved at: <https://technequality-project.eu/files/d36fdadulthoodeducationv1020-12-2021pdf>).

- Jackson, M. (2006). Personality traits and occupational attainment. *European Sociological Review* 22(2), 187–199.
- Korpi, T., & Tählin, M. (2021). On-the-job training: A skill match approach to the determinants of lifelong learning. *Industrial Relations Journal* 52, 64–81.
- Lamont, M. (2012). Toward a comparative sociology of valuation and evaluation. *Annual Review of Sociology* 38(1), 201–221.
- Leuze, K. (2007). What makes for a good start? Consequences of occupation-specific higher education for career mobility. *International Journal of Sociology* 37(2), 29–53.
- Levels, M., van der Velden, R., & Di Stasio, V. (2014). From school to fitting work: How education-to-job matching of European school leavers is related to educational system characteristics. *Acta Sociologica* 57(4), 341–361.
- Liu, Y., & Grusky, D. (2013). The payoff to skill in the third industrial revolution. *American Journal of Sociology* 118, 1330–1374.
- Maurice, M., Sellier, F., & Silvestere, J.-J. (1986). *The Social Foundations of Industrial Power*. Cambridge, MA: MIT Press.
- Meyer, J.W. (1977). The effects of education as an institution. *American Journal of Sociology* 8, 55–77.
- OECD (2021). *Education at a Glance 2021: OECD Indicators*. Paris: OECD Publishing.
- Passaretta, G., & Skopek, J. (2021). Does schooling decrease socioeconomic inequality in early achievement? *American Sociological Review* 86(6), 1017–1042.
- Rauscher, E. (2015). Educational expansion and occupational change. *Social Forces* 93(4), 1397–1422.
- Reimer, D., & Jacob, M. (2011). Differentiation in higher education and its consequences for social inequality. *Higher Education* 61, 223–227.
- Schindler, S., Weiss, F., & Hubert, T. (2011). Explaining the class gap in training: The role of employment relations and job characteristics. *International Journal of Lifelong Education* 30, 213–232.
- Schofer, E., & Meyer, J.W. (2005). The worldwide expansion of higher education in the twentieth century. *American Sociological Review* 70(6), 898–920.
- Shavit, Y., & Müller, W. (eds.) (1998). *From School to Work*. Oxford: Clarendon Press.
- Skopek, J., & Passaretta, G. (2021). Socioeconomic inequality in children's achievement from infancy to adolescence. *Social Forces* 100(1), 86–112.
- Strello, A., Strietholt, R., Steinmann, I., & Siepman, C. (2021). Early tracking and different types of inequalities in achievement. *Educational Assessment, Evaluation and Accountability* 33, 139–167.
- Tilly, C. (1998). *Durable Inequality*. Berkeley, CA: University of California Press.
- Tomaskovic-Devey, D., & Avent-Holt, D. (2019). *Relational Inequalities*. New York: Oxford University Press.
- Turner, R.H. (1960). Sponsored and contest mobility and the school system. *American Sociological Review* 25(6), 855–867.
- van de Werfhorst, H.G. (2004). Systems of educational specialization and labor market outcomes in Norway, Australia, and The Netherlands. *International Journal of Comparative Sociology* 45(5), 315–335.
- van de Werfhorst, H.G. (2011). Skill and education effects on earnings in 18 countries: The role of national educational institutions. *Social Science Research* 40(4), 1078–1090.
- van de Werfhorst, H.G. (2017). Vocational and academic education and political engagement. *Comparative Education Review* 61(1), 111–140.

- van de Werfhorst, H.G. (2019). Early tracking and social inequality in educational attainment: Educational reforms in 21 European countries. *American Journal of Education* 126(1), 65–99.
- Vera-Toscano, E., Rodrigues, M., & Costa, P. (2017). Beyond educational attainment: The importance of skills and lifelong learning for social outcomes. *European Journal of Education* 52, 217–231.
- Woessmann, L. (2005). The effect heterogeneity of central examinations. *Education Economics* 13(2), 143–169.
- Zull, J.E. (2006). Key aspects of how the brain learns. *New Directions for Adult and Continuing Education* 110, 3–9.