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Training the ‘Workforce of the Future’: Insights from Work-Based Higher Education Programs in Germany and the United States

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Summary

In the face of rapid technological change, industrialized economies around the world share concerns about a growing mismatch between employers’ needs and workers’ skills. Debates about how to effectively prepare the ‘workforce of the future’ have brought to the forefront different approaches to fostering collaboration between companies, individuals, and public actors in the education and professional development space. Pairing data on the evolution and design of Work-Based Higher Education (WBHE) programs in the United States and in Germany with insights from two in-depth case studies, we show how a shared idea - the ‘integration of theory and practice’- manifests in both countries. Focusing on the responsibilities and activities of companies and higher education institutions (HEI) across four dimensions - ‘Admission and Recruitment’ (A&R), ‘Curriculum Design and Renewal’ (CD&R), ‘Instruction and Training’ (I&T), and ‘Assessment and Examination’ (A&E) - we find that, in Germany, the influence of industry is both stronger and more regulated than in the US, where individual academic institutions have greater control of and more freedom in determining the specificities of collaborations. These differences result in diverging levels of comparability and standardization of programs which, in turn, influence both countries’ ability to train the ‘workforce of the future’.

As digital technologies and automation increasingly modify job content and transform the nature of entire occupations, skill requirements, too, are changing. With numerous studies finding that the ‘work of the future’ will increasingly require individuals to perform ‘traditional’ tasks with the assistance of software robots and other machines that are powered by artificial intelligence, experts across different industries see an increased demand for workers with digital skills and an innovation-friendly mindset along with a continued need of excellent technical and social skills (Cedefop 2018, Cedefop and Eurofund 2018, McKinsey 2018, WEF 2018). As demographic change may further constrain a company’s access to highly qualified individuals (Berthold, C. et al. 2009), employers are increasingly calling for action that is both effective and scalable. In this context, work-based learning (WBL) has received substantial attention. While particularly successful vocational education training (VET) systems like those of Germany or Switzerland have caught the eye of decision-makers around the world for quite some time (Brown and Lorenz 2017), there is an increasing awareness of the need to also reform traditional college education with a view to making it more relevant to the workplace. Responding to this demand, this paper provides an in-depth analysis of work-based higher education (WBHE), a form of training that is characterized by the integration of theory and practice through the collaboration of companies and higher education institutions (HEI). While

WBHE programs are not a new phenomenon and increasingly form part of many country's education system, little is known about their specific design and implementation.

This paper addresses this shortcoming by focusing on two illustrative examples of WBHE programs - one in the United States and one in Germany - with a view of the ways in which they organize the collaboration of different actors with regard to integrating theory and practice. Looking at four dimensions - 'Admission and Recruitment' (A&R), 'Curriculum Design and Renewal' (CD&R), 'Instruction and Training' (I&T), and 'Assessment and Examination' (A&E) – we find that the co-op degree programs offered by Wentworth Institute of Technology (WIT) in Boston, Massachusetts, are characterized by a strong academic influence. The *Duales Studium* (dual study program) at the *Deutsche Hochschule Baden-Wuerttemberg* (Cooperative State University Baden-Wuerttemberg), by contrast, is shaped by a more equal partnership with industry. These different practices lead to a stronger focus on industry-specific knowledge and skills in Germany, and the promotion of more general, academic skills in the US. As the influence of industry in Germany is not only stronger, but also more regulated than in the US, we also observe higher levels of comparability and standardization of programs which, in turn, influence general awareness of and generate positive attitudes towards WBHE. By contrast, in the US, where the design and quality of co-op programs vary highly among institutions, it takes significantly more effort by companies and individuals to navigate the WBHE space. This, in turn, may result in the comparatively lower level of interest generated by these programs and, as a consequence, a missed opportunity to use WBHE as an effective way to train the 'workforce of the future'.

Method and case study selection

To illustrate key characteristics of and differences between co-op programs in the US and dual study programs in Germany, this study draws on the large body of literature on different systems of skill formation and educational governance. This body of work identifies the systemic and governance-related differences that distinguish Germany's collective skill formation system and the US' liberal one (see e.g. Graf 2017, Busemeyer and Trampusch 2012, Estevez-Abe, Iversen and Soskice 2001) and underlines how educational policies fit within the overarching framework of industrial relations (Thelen 2014, 2004; Hall and Soskice 2001). Our analysis, by contrast, suggests that a focus on national differences alone is insufficient in explaining differences in the organization and implementation of higher education at the institutional level as it occurs not only *between*, but also *within* countries. The analytical framework presented here therefore integrates insights into the broader differences between the German and American education systems with observations of how different HEI chose to organize themselves and operate under a given framework.

Reflecting this approach, we draw on descriptive material collected at the HEI and firm level as well as on publicly available data on education and workforce development in both countries. In light of the fact that access to such data was considerably better in Germany, where organizations like the *Bundesinstitut fuer Berufliche Bildung* (BIBB) or the *Hochschulrektorenkonferenz* (HRK) systematically collect and administer relevant information¹, we chose to complement our findings

¹ In addition to databases such as *AusbildungsPlus* (BIBB) and *Hochschulkompass* (HRK), other relevant sources of information in Germany include the *Bildungsbericht* by the *Leibniz-Institut für Bildungsforschung und Bildungsinformation*, and the

with insights from two case studies: Cooperative State University Baden-Wuerttemberg (*Duale Hochschule Baden-Wuerttemberg, DHBW*) in Stuttgart, Germany, and Wentworth Institute of Technology (WIT) in Boston in the US. To identify relevant processes and governing frameworks at these two leading practice-oriented HEIs, we collected information about how they organize cooperation with industry through internal and external reports² as well as 52 semi-structured interviews with students, alumni, faculty, and members of the administration of both HEI.

While we stress that the practices of DHBW and WIT are not representative of the entirety of WBHE in each country³ and differ in a number of significant ways⁴, they both can serve as powerful illustrations of how dual study programs and co-op programs are typically organized and implemented in the different contexts. These two HEI furthermore lend themselves to a structured and systematic comparison of their WBHE programs in light of the fact that both institutions are former trade schools which, over time, were granted ‘university’ status and became recognized as innovative actors in the design and implementation of compulsory WBHE programs. Moreover, they both have excellent relations with local industry and are committed to improving their respective communities by providing a solid education to individuals from a wide range of backgrounds. Finally, both institutions offer undergraduate and graduate programs which combine on-the-job training and traditional academic studies in the STEM field⁵, an area which is said to provide particularly attractive opportunities for future employment in either country. In the following section, we will provide a brief overview of the German and US WBHE systems, before elaborating on the specifics of each institution’s program.

1. Work-based higher education in Germany and the United States

Germany

Dual study programs were first developed in the early 1970s through initiatives by powerful corporations in the southwest of the country (Lehr 2015) and in response to demographic changes that also affected the education space: After an increase in new high schools in the 1960s and 70s, Germany faced a growing number of high school graduates who wished to pursue a higher education degree. This raised questions about the appropriate organization of education and the potential of graduates to obtain high-quality and future-oriented jobs, and triggered innovation in

Akkreditierungsrat. Meanwhile in the US, it is mostly participating universities themselves which collect information on their activities.

² These included documents on the organization and management of each institution as well as evaluation reports and legal guidelines governing higher education.

³ With a view of work-based learning more generally, Carnevale et al. stress that “programs are often the same in name only” and “have different values at different institutions depending on the alignment between particular curricula and regional labor market demand, as well as on differences in program quality” (2015, p.18).

⁴ Founded in the early 1970s, DHBW is a public institution with multiple locations and approx. 33,000 students across its nine locations. It does not charge tuition fees, but draws on public funds as well as its own foundation to pursue its educational mission. WIT, by contrast, is a private school whose origins date back to the year 1911. It relies largely on students’ tuition and fees, which in 2019 were \$33,950 for undergraduate and \$36,750 for master degree programs.

⁵ The term groups together the academic disciplines of Science, Technology, Engineering and Mathematics and includes subjects such as biology, physics, chemistry, as well as logic and statistics. It is used in contrast to the social sciences, including psychology, sociology, and political science, which are frequently grouped together with humanities and arts under the acronym HASS (Humanities, Arts, and Social Sciences).

the education sector. The *Berufsakademien* in Stuttgart and Mannheim, for instance, experimented with a new form of education that combined technical and academic skills, drawing heavily on some of the key characteristics of Germany's Vocational Education and Training (VET) system: the close integration of two places of learning⁶, quality control through competent institutions, the recognition of certificates among employers⁷, and legally binding work and salary conditions.

Elsewhere, universities of applied sciences (UAS) were created as institutions with a particular focus on instruction (Niederdenk 2013). Having overcome their initial perception as second-order academic institutions designed to address companies' fears of a future shortage of employees with in-depth practical training and theoretical skills, UAS have now outgrown traditional universities in numbers: Of the 396 HEIs that existed in Germany in 2018, 121 were universities, and 218 universities of applied sciences (HRK 2018).⁸ Moreover, they have significantly expanded their activities, frequently leading research efforts and taking on an increasingly powerful role in shaping the debate about the future of education and digitization (Niederdenk 2013, UAS7 2018). With the proliferation of these new institutions also came the rise of the *Duales Studium*. Despite the latter's immediate success at the regional level⁹, it initially remained a niche form of education, generating little interest from both policy-makers and potential participants.

This changed in the early 2000s, when the German government became aware of the potential of WBHE to address expected shortages of qualified workers, a growing demand for knowledge and skills across many sectors, and challenges arising from an increasingly heterogeneous student body (Draeger and Ziegele 2014). Helpful for the proliferation of dual study programs in Germany was furthermore the assessment by education experts who underlined that WBHE could contribute to the academization of certain industries or occupations, the training of specialists in the fields of mathematics, computer science, science and technology (MINT), and the promotion of lifelong learning (Berhold et al, 2009). In light of these insights and following the implementation of various policies that raised the status of UAS, including (ongoing) initiatives to extend their competencies in the context of the Bologna reform, WBHE saw a considerable increase in student enrollment, both overall as well as in relation to traditional university degrees and vocational education and training (see figure 1a and 1b). In 2016, the number of students enrolled in dual study programs for the first time exceeded 100,000. While this is still low in comparison to enrollment in traditional degrees or VET programs, it was seen as a clear indication of the growing popularity of this comparatively new education format.

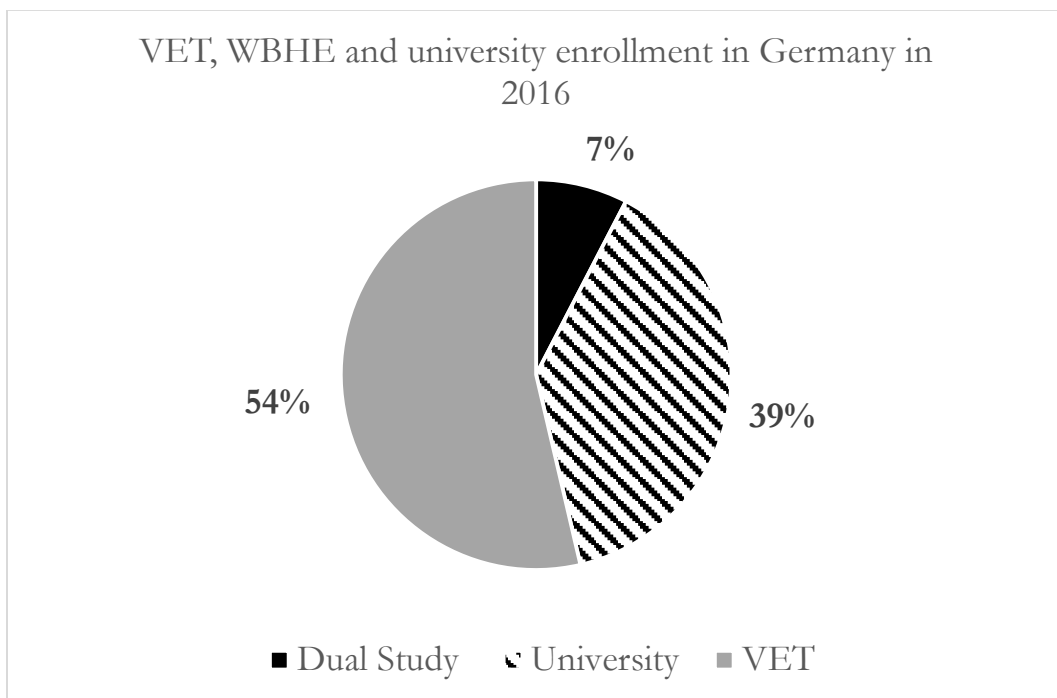
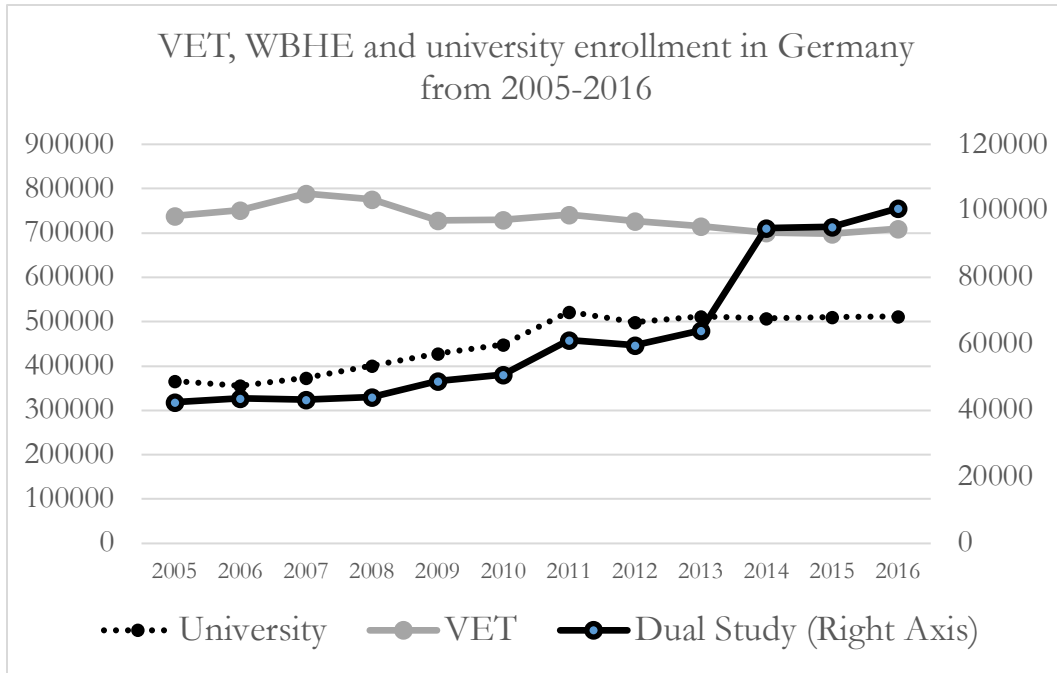
⁶ In the case of VET, these are (mostly) small and medium-sized companies and publicly funded vocational schools.

⁷ Apprenticeship certificates are issued by a chamber of industry and commerce, or of crafts and trades.

⁸ The remaining 57 institutions are Colleges of Art and Music.

⁹ Within less than a decade after its initial implementation, the test phase for the education model was declared successful by the state legislature of *Baden-Wuerttemberg*, and the *Berufsakademien* became firmly anchored in the latter's education system.

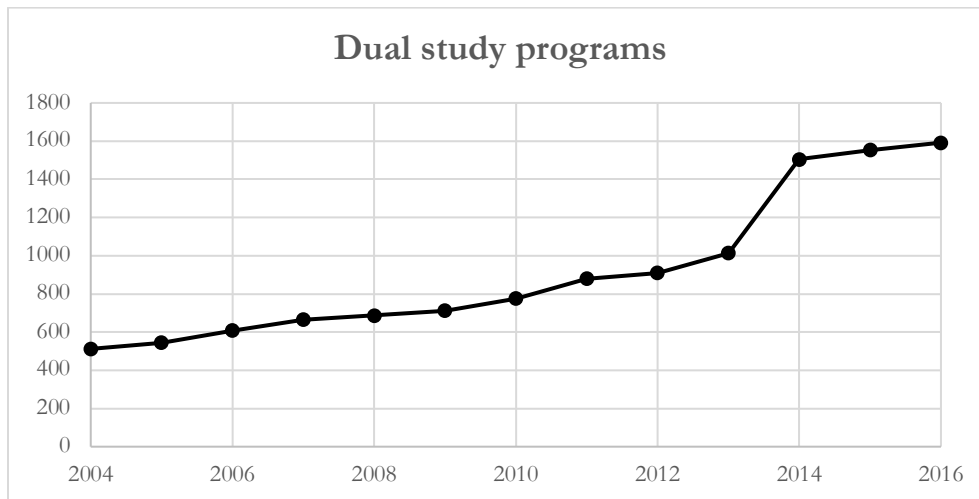
Figure 1: VET, WBHE and traditional university degrees in Germany (2005 to 2016)



Source: Adapted from: AusbildungPlus Duales Studium in Zahlen 2016 (BIBB 2017b), BIBB Datenreport 2018.

In line with student enrollment, also the number of programs grew (see figure 2) and the fields of study offered were expanded, particularly in engineering, business administration, and computer science (BIBB 2017b).

Figure 2: Growth of dual study programs in Germany 2004 to 2016



Source: Adapted from: AusbildungPlus Duales Studium in Zahlen 2016 (BIBB 2017b).

In recent years, the trend towards WBHE has been exacerbated further by the fact that along with UAS and *Berufsakademien*/DHBW, also traditional universities have begun to explore WBHE as a learning format. Even though absolute numbers are still comparatively low – in 2015, only 6% of all dual study programs were offered by universities, compared to 59% at UAS (Theis 2015) – there appears to be a growing interest in bringing the dual study model to other HEI. At the same time, many UAS are becoming increasingly research-oriented. In light of this narrowing gap between the academic profiles of the different institutions, reputation no longer appears to be the key impediment to the proliferation of dual study programs among traditional universities. Rather, organizational challenges related to offering dual study programs are now seen as a hindering factor (Berthold 2009, p.23-25).

Along with the number and forms of dual study programs, partnerships with companies increased. In 2016, approx. 47,000. companies partnered with HEI in dual study programs. The latter included apprenticeship-integrating (*ausbildungintegrierend*), practice-integrating (*praxisintegrierend*), as well as career-integrating (*berufsbegleitend*) programs (Wissenschaftsrat 2013; Table 1).¹⁰

¹⁰ The first two are the most relevant for this paper, as they fall in the space of initial education, whereas career-integrating dual study programs are a form of continuing education. Increasingly, practice-integrating programs, too, are being tailored towards more experienced learners (BIBB 2017).

Apprenticeship-integrating and practice-integrating programs differ across a number of categories, including average duration, the way in which they organize theory and practice phases, and the general guidelines that different actors are required to follow. Moreover, they lead to distinct forms of certification and demand different forms of commitment by companies: *Ausbildungsintegrierende* programs confer both an apprenticeship certificate as well as a study degree to graduates and require companies to be formally recognized training providers (*anerkannter Ausbildungsbetrieb*), i.e. to meet the standards that are set by industry associations in addition to the general laws that govern education in a specific state or HEI (Thies 2015, p.6). *Praxisintegrierende* programs, by contrast, solely lead to a higher education degree – usually a Bachelor’s – and only require companies to adhere to the more general rules (see Table 1) (BIBB 2017, p.10).¹¹ Recently, there has also been an increase in ‘mixed formats’, i.e. programs that can be taken in an apprenticeship-integrating or a practice-integrating format.

Table 1: Overview of dual study programs and guidelines

Form of education	Dual study format (certificate/degree conferred)	Guidelines for companies	Guidelines for HEI
Initial	Apprenticeship-integrating (apprenticeship certificate and HEI degree)	<ul style="list-style-type: none"> - Certified training provider – status (<i>anerkannter Ausbildungsbetrieb</i>) - contractual agreements with trainees - contractual agreements with HEI 	<ul style="list-style-type: none"> - regional laws - accreditation guidelines - HEI’s own study regulations
Initial	Practice-integrating (HEI degree)	<ul style="list-style-type: none"> - contractual agreements with trainees - contractual agreements with HEI 	<ul style="list-style-type: none"> - regional laws - accreditation guidelines - HEI’s own study regulations
Further	Career-integrating (HEI degree or other certificate)	<ul style="list-style-type: none"> - contractual agreements with trainees - contractual agreements with HEI 	<ul style="list-style-type: none"> - regional laws - accreditation guidelines

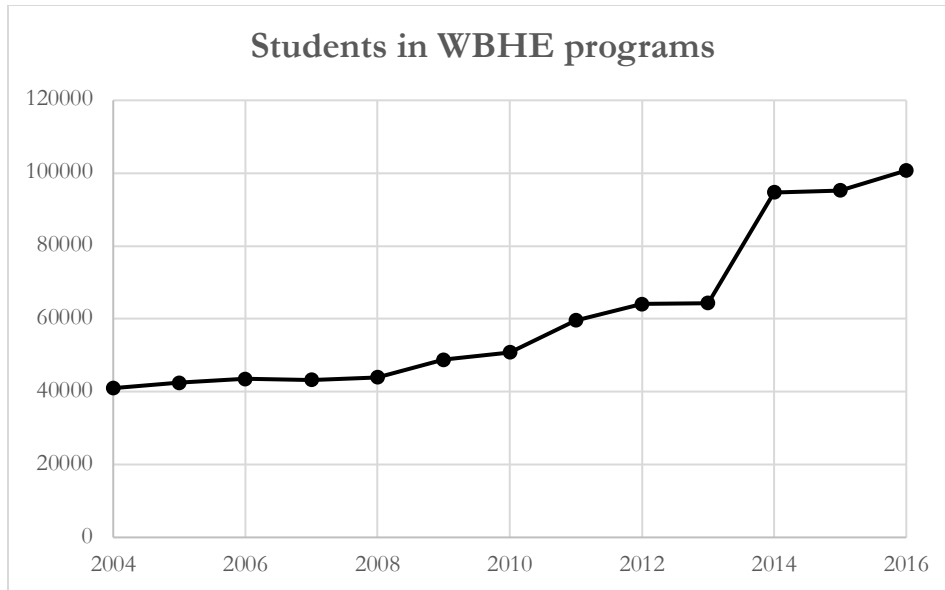
¹¹ In addition, large companies increasingly build their own training programs, which – while drawing on existing guidelines – enable firms to teach more company-specific content.

			<ul style="list-style-type: none"> - HEI's own study regulations
Further	Practice-integrating (HEI degree)	<ul style="list-style-type: none"> - contractual agreements with trainees - contractual agreements with HEI 	<ul style="list-style-type: none"> - regional laws - accreditation guidelines - HEI's own study regulations

Source: Author.

Most dual study formats are offered in only way and tend to be linked to particular (types of) HEI. The choice for a specific format usually lies with the company and is a consequence of the latter's preferences and resources. Here, larger companies are clearly at an advantage and therefore increasingly showing an interest in dual study programs. While in 2016 the vast majority - 72% - of industry partner were SMEs, the number of large corporations offering dual study programs has been increasing quickly in the face of a shortage of skilled professionals in Germany and steep international competition. Seeing dual study programs as a way to attract, acquire and retain employees and maintain a competitive advantage, many larger corporations invest in building bespoke programs, partly run by their own 'academies' or 'universities'. This practice of adding a third place of learning to the preexisting two, which is also reflected in the growth of the practice-integrating dual study format, has triggered some criticism as it is perceived as a risk to the comparability of degrees in terms of the knowledge and skills acquired. Yet, these programs tend to be rather popular with students, are likely to increase in numbers and contribute strongly to the stark increase in enrollment numbers since 2004 (Figure 3).

Figure 3: Growth in number of students enrolled in dual study programs in Germany: 2004 to 2016



Source: Adapted from: AusbildungPlus Duales Studium in Zahlen 2016 (BIBB 2017b).

Perhaps the most striking change in the sphere of dual study programs has, however, been the growing interest of highly qualified students. In the past, the intellectually most gifted high school graduates quasi ‘automatically’ opted for a higher education degree at a traditional university, following the assumption that this would provide them with good career prospects. In recent years, however, this practice has been changing as students – especially in the STEM fields – begun to express a preference for programs with a greater weight on the applicability of course content. During the interviews conducted for this study, current students and recent alumni furthermore explained this shift in mindset with the hope for more interesting work, and the opportunity to become part of a team. Numerous students furthermore mentioned that they felt concern about an increasingly insecure labor market and working conditions in the ‘gig economy’, and therefore appreciated the prospect of establishing a relationship with an employer early on. The fact that these perceptions were also shared by particularly well-performing high school graduates and that studies have shown that the cognitive abilities of students in Germany cannot be determined by the type of HEI they opt for (Trautwein et al. 2006), thus suggests that dual study programs constitute an attractive educational pathway for a wider range of individuals than just those with a limited interest in or low likelihood of successfully completing a traditional degree program. Rather, it appears that both average students as well as ‘high performers’, i.e. students who are among the top ten per cent of high school graduates, are increasingly attracted to programs that offer a practice-oriented approach to learning along with the prospect of increased stability.¹² In other words, at a time of rapid economic transition and high degrees of perceived uncertainty, the prospect of finding gainful and sustained employment with a company of one’s choice early on has begun to trump the presumed societal merits of attending a particular university.

¹² A side effect of this change in student preferences has also been the greater openness of renowned institutions like the *Studienstiftung des deutschen Volkes*, which has long focused on supporting elite students at traditional universities, to accepting dual students into their mentorship and financial assistance programs.

United States

In the United States, work-based higher education is still an emerging field and the ‘co-op’ category in particular is rather poorly defined and sometimes seen as distinct from higher education. In its Career & Technical Education Statistics, the National Center for Education Statistics (NCES), for instance, categorizes co-ops as one of many different work experience programs, along with internships, practicums, clerkships, externships, residencies, clinical experiences, and apprenticeship programs. In its Adults Training and Education Survey (ATES), NCES moreover refers to co-ops as a form of “training for working-class youth” (National Center for Education Statistics 2017). This assessment is inaccurate as it fails to appreciate the diversity of co-op programs that exist in the US, and neglects in particular the fact that they are frequently administered and were indeed founded by four-year institutions. Initially established at the University of Cincinnati in the early 1900s, co-ops were based loosely on the UK’s “sandwich courses” (Sovilla and Varty 2004) and reflected the idea that people learn best from experience and doing rather than mere abstraction, especially in the field of engineering. After an initial wave of “great resistance from both traditional educators and non-committed industrialists” (Haddara and Skanes 2007, p. 67), co-op programs soon expanded across the United States and increasingly triggered participation by a wide range of industries. Eventually, they also became part of the offerings of community colleges (CCs)¹³, a particularly relevant part of the US education system. While today CC offer the majority of co-op programs and serve about 40 percent of all undergraduates (Ginder et al. 2017)¹⁴, these programs are often associated with vocational education and training, or activities that “take time away from the classroom” (Crow 1997).

This point of view is also reflected in the idea that co-ops are mostly a way to address the shortage of workers with “middle skills”, i.e. qualifications that go beyond what is learned at a high school, but that do not match those of a four-year degree (National Skills Coalition 2017).¹⁵ This perception is problematic as it ignores the fact that a significant number of co-ops are run by four-year institutions which tend to have a much stronger focus on academic content than on practical skills.

Associating co-ops first and foremost with community colleges furthermore ignores the fact that – similar to their German counterpart – high quality programs aim to promote a constructive and mutually beneficial partnership between the academic institution, the employers and the trainee for a much longer time frame than the time it takes to get an associate’s degree. These co-op programs are characterized by companies’ promise to advance students’ education, while paying a reasonable salary in exchange for access to new talent, fresh perspectives, and the prospect of

¹³ Similarly, a notable university ranking, refers to co-ops as a form of training that “require(s) or encourage(s) students to apply what they’re learning in the classroom out in the real world” (US News 2019) rather than as a way to acquire knowledge in a more integrated way.

¹⁴ Rather than for the important services they provide to many Americans, CCs are often known for their comparatively high dropout rates. As many of their graduates furthermore obtain an associate’s rather than a bachelor’s degree, community colleges have the reputation as being institutions of inferior quality.

¹⁵ Analyses of data by the Bureau of Labor Statistics has found that only forty three percent of U.S. workers are trained for the fifty three percent of U.S. jobs that are middle skill (National Skills Coalition 2017).

maintaining a well-trained workforce.¹⁶ The fact that this crucial aspect does not feature in most official definitions suggests that there is a mismatch between the current status quo and the desired amount of collaboration of HEI and companies. It also points to the absence of national standards for the organization and classification of this type of education, despite the efforts by organizations such as the Association of Cooperative Colleges (ACC)¹⁷ and the NCCE¹⁸.

While one may criticize the lack of a systematic and universally accepted way of classifying and categorizing the large number of programs and practices that shape the US WBHE space, it is noteworthy that the current system provides HEI with a lot of leeway. Compared to their German counterparts, for instance, American HEI have much more freedom to establish collaborations with companies on their own terms and to shape the design and implementation of their programs. The following section will elaborate on this aspect in further detail.

2. Dimensions of cooperation between HEIs and companies in work-based higher education programs

In the US as well as in Germany, WBHE programs are designed to integrate theoretical and applied knowledge through the close cooperation of HEI and companies. Yet they do so in rather distinct ways. Table 2 identifies four areas that crucially shape the profile of a WBHE programs and thereby influence the extent to and ways in which individuals are being prepared for the ‘work of the future’.¹⁹

The first, ‘Student Recruitment and Admission’, refers to how individuals find and are ‘recruited into’ specific programs, and describes the role that HEIs and companies play in the process. Thereafter ‘Curriculum Design and Renewal’, i.e. the “ongoing, cyclical, and analytical process, that continually strives to find new and effective ways to offer students learning experiences that are transformational, inspiring, and intellectually challenging” (Queens University 2019) focuses on the identification and further development of learning outcomes and the choice of appropriate instruction methods. The third comparative dimension, ‘Training and Instruction’, then focuses on how WBHE programs combine didactical knowledge and subject-level expertise through the careful selection and integration of instructors with practical expertise and the organization of theory-focused and practice-oriented learning phases. Lastly, “Assessment and Examination” investigates how the interaction and relative power of companies and HEI differs when it comes to conveying information and assessing performance.

Table 2: Analytical dimensions for HEI-company cooperation

¹⁶ The fact that this crucial aspect does not feature in most official definitions suggests a mismatch between the aspirations for and the actual extent of collaboration between HEI and companies.

¹⁷ Founded in 1926, the ACC is the first professional association for cooperative education.

¹⁸ In 1961, a study of cooperative education authorized and commissioned by the Ford and Edison Foundations resulted in the formation of the National Commission for Cooperative Education (NCCE), an organization dedicated to promoting and lobbying for cooperative education in the US.

¹⁹ Table 1 provides an overview of four areas that illustrate these differences with reference to two specific institutions, offering WBHE programs, DHBW and WTT.

<u>Area of cooperation</u>	<u>Level of analysis</u>	<u>Indicators</u>
Student Recruitment and Admission	HEI admin office, HR departments	<ul style="list-style-type: none"> • Form of involvement of HEI/company in selecting students • Financial aspects related to admission
Curriculum Design and Renewal	Consultation bodies	<ul style="list-style-type: none"> • Type of (formal and informal) feedback channels • Dynamics of collaboration (including type and frequency of interaction and final decision-making power)
Training and Instruction	Classroom and company facilities	<ul style="list-style-type: none"> • Instruction method and organization of practice phases (duration, intensity, mentoring) • Instructor profile (number/percentage of total faculty, qualifications, position/title, training requirements, evaluation/performance indicators)
Assessment and Examination	Faculty/industry representatives	<ul style="list-style-type: none"> • Relative power of company and faculty in grading process • Metrics used for grading/evaluation (company-specific vs. general; pass/fail vs. other)

Source: Author.

Student recruitment and admission

In Germany, high school graduates who are interested in pursuing a dual study program submit their materials directly to the company of their choice. They then undergo an often rather selective screening and selection procedure which - depending on the firm - may entail several rounds of assessment centers and in-person interviews. Often, this recruitment process resembles that used for candidates at other career stages, especially in larger companies.²⁰ Upon successful application to a company, students then receive a training contract which serves as a prerequisite for their enrollment at the HEI, which – in turn – has a separate cooperation agreement with its practice partners. Students thus do not have to pass any additional (academic) requirements or tests to be admitted and enter into contractual relations with the HEI. Evidence that they hold the required high school graduation diploma (*Abitur* or *Fachabitur*) which enables them to enroll in a degree

²⁰ While especially internationally renowned German companies are frequently able to select among a large number of highly qualified candidates (Krone et al. 2019), it has been a specific feature of the German economy that also so-called ‘hidden champions’, i.e. small and medium-sized enterprises (SMEs) with a significant market share in a particular area, are seen as attractive training providers and employers.

program suffices at this stage.²¹ As a consequence, DHBW has little say in the composition of its student body.

At WIT, by contrast, and as a result of the organizational and temporal structure of the programs - in a time frame of 4-5 years, students participate in two co-ops, usually with different companies - decision power in the field of admissions lies exclusively with the university and the latter's eligibility requirements. These can vary by discipline, but generally require a minimum grade point average (GPA), and a letter of motivation that demonstrates that the candidate is aligned with the university's mission and values. While companies can occasionally indirectly influence the selection process by offering (partial) scholarships for tuition to students of a specific demographic group, they do not have a say in which or how students are recruited or admitted. Rather, their interaction with graduates is facilitated through on-campus events such as career fairs and workshops, administered by WIT's Co-op Office, the university's career service, or its industry outreach service. These encounters then serve as an opportunity for the companies to be visible to the larger student body and enable firms to actively recruit students once they have been admitted to the university.²²

Also the way in which the programs are financed results in differences between DHBW and WIT with regard to recruitment and selection: DHBW does not charge tuition fees for its bachelor's and consecutive master's degree programs, and students merely pay a small enrollment or confirmation fee.²³ The university thus has no reason - or ability - to admit students from a particular socioeconomic background over others. As long as applicants fulfill the general admission criteria and there is capacity, they will be accepted. At WIT, by contrast, tuition fees constitute a key source of income, making applicants' 'resourcefulness' a potential factor for selection. That being said, WIT faculty and administrators stressed, that students are selected solely based on their motivation, likelihood of successful graduation, and fit with the program, alluding *inter alia* to the generous scholarships that are available to high-need students, who were described as "an under-tapped talent pool".

Curriculum design and renewal

A continuous and in-depth exchange with industry partners about strategic perspectives and skill demands is an objective that DHBW and WIT pursue proactively. While both institutions seek feedback on the quality and relevance of their current curriculum and strive for input into how the latter can be enhanced to better meet the requirements of the labor market, they do so in rather distinct ways: DHBW entertains close relationships with companies and practitioners both through personal contacts as well as through a carefully designed organizational set-up. First, industry representatives are closely integrated into the university's top-level governance structure, making up

²¹ Occasionally companies also require candidates to pass a six-months employment probation period before they are fully admitted into the firm's dual study program.

²² By providing visibility for employers and facilitating touch points between students and companies, the co-op office thus has an important support function. While it organizes workshops and mock interviews to help students prepare to apply for co-ops, and maintains a portal where companies can post open positions, it is students' explicit responsibility to find partnering companies and the co-op office does not interfere in the application process.

²³ The fee is normally covered by the partner company.

50 percent of the members of the managing board and the senate, while eight of the 17 members of the supervisory board come from the private sector (DHBW 2019). Company representatives furthermore play an important role in the *Fachkommissionen* (commissions of subject specialists) which oversee *inter alia* adaptations of the current curriculum. If a *Studiengangsleiter* (degree program coordinator), i.e. the lead faculty of a specific study program, identifies a need for and design for a new module, for instance, it will be reviewed by the relevant *Fachkommission*.²⁴ In this context it is important to note that these individuals are asked to take on a broader vision, i.e. not to speak to the interests of specific companies alone, but to reflect on and provide recommendations based on the general direction of their industry. This approach is facilitated by the fact that many of the industry representatives involved in curriculum- or governance-related decisions at DHBW tend to be rather senior figures in their respective organization and often well-known across a specific sector.²⁵ This allows them to meet academic faculty ‘eye-to-eye’ and to provide comments and feedback not only on the technical components of the programs, but also on general trends concerning the industry. Importantly, all of these forms of industry involvement are laid out systematically, both by the university and as well as the State of Baden-Wuerttemberg, in an accessible set of codes and rules.

It is here that WIT differs considerably from its German counterpart. While the WIT co-op program has multiple channels by which it can bring in industry expertise, it tends to be less formalized and based strongly on personal connections. Moreover, there seems to be less of a focus on ensuring equal representation of and thereby interaction with faculty. Wentworth’s governing body, the Board of Trustees²⁶, for instance, is comprised exclusively of industry representatives, many of whom are also WIT alumni. The same holds for ‘Industry Advisory Committees’, groups of industry representatives who discuss a wide range of issues, including the performance and potential need for reform of specific programs²⁷ and the 30-50 University Advisers who provide additional insights to the administration and trustees on issues of strategic importance.²⁸ A problematic issue in this context is that industry representatives regularly seek to promote learning content that is closely tied to their respective business practices and needs, but not necessarily to those of the industry sector at large.²⁹ This can – at least in part – be attributed to the fact that industry representatives on the respective committees are often technical experts who, by the very nature of their positions, seek to advance their firm’s specific interests with regard to training. In this regard, their interests frequently conflict with those of academic faculty, who wish to keep the curriculum

²⁴ The *Studiengangsleiter* is also free to incorporate the advice of external partners.

²⁵ Typical examples of this group are managers or executives of highly successful SMEs, so-called ‘hidden champions’.

²⁶ The Board of Trustees oversees policy making, planning, and the financial welfare of the school.

²⁷ Industry Advisory Committees advise on the continuous development and evolution of study programs and advise departments of the professional requirements of the private and public sectors and the implications of those requirements upon the curriculum. Specifically, they provide a forum to discuss teaching, research, professional development, and academic excellence relative to the needs of the profession and related industries and assist with the development strategies for recruiting students to the programs and to internships, co-op, and permanent positions. Composed of 10-20 individuals who meet between one to three times a year, IACs furthermore assist academic departments in locating funds and gifts for their educational and outreach programs.

²⁸ Through their participation in Board of Trustee Committees, University Advisors can provide insights into “industry trends related to preparing the workforce of the future to ensure that the university remains at the forefront of student success and employer satisfaction, and students are properly prepared for full-time work” (WIT 2019).

²⁹ At one industry advisory committee, companies even pay a fee to gain a seat on the table.

broad and general enough to meet the demands of a wider range of firms. This finding suggests, again, that the continuous dialogue between faculty and industry is highly relevant. As shown by DHBW, the careful design of boards and committees with a view to ensuring equal representation of both groups can be helpful in this regard.

Instruction and training

When it comes to the design of instruction and training in Germany, companies offering apprenticeship programs must present a strategic training plan, designed on the basis of an extensive set of rules which, assured by third actors³⁰, outlines information on the factual and temporal structure (training plan) of each program.³¹ While recent changes in its accreditation status have enabled DHBW to exercise greater power in ensuring alignment between the practical and academic dimension of learning content³², its curriculum thus continues to have to meet standards overseen by different ‘outside parties’.³³ In the US, by contrast, the absence of a comparably extensively regulated structure means that co-op programs are anchored solely within the general accreditation guidelines for the university. This allows the university to determine independently whether and to which extent it wants to rely on external partners to provide feedback on or determine the contents of the curriculum. This leads to a closer and more systematic integration of theory and practice in the German context than in the US. The effect is further enhanced by the fact that at DHBW, only about 40 percent of courses are taught by the full-time academics of DHBW or partner universities. While these professors also tend to have a lot of industry experience³⁴, most teaching staff are experts, employed mainly by partner companies or social institutions. This has implications for the teaching and instruction methods as it favors instruction with a strong reliance on real-world examples and case studies rather than abstract knowledge or theory.

Most crucially, however, DHBW’s instruction model is characterized by a highly formalized alternation of practical and theoretical phases which take place at different sites of learning. For instance, operating on a non-stop, twelve-month schedule, the program grants vacation days as stipulated in the three-year employment contract signed between the student and the partner company at the beginning of the dual study program. Furthermore, following a clearly defined three-month rhythm (see Figure 4), DHBW’s *Blockmodell* (block model), which governs approximately 80% of all dual study programs in Germany, is perceived to be particularly effective at promoting a direct link between theoretical knowledge and practical skills while providing ample opportunities to

³⁰ These actors are the German Chambers of Industry and Commerce, IHK and HWK.

³¹ All partner companies of DHBW thus have to show how the practical training components fit within and complement the academic contents of each learning module.

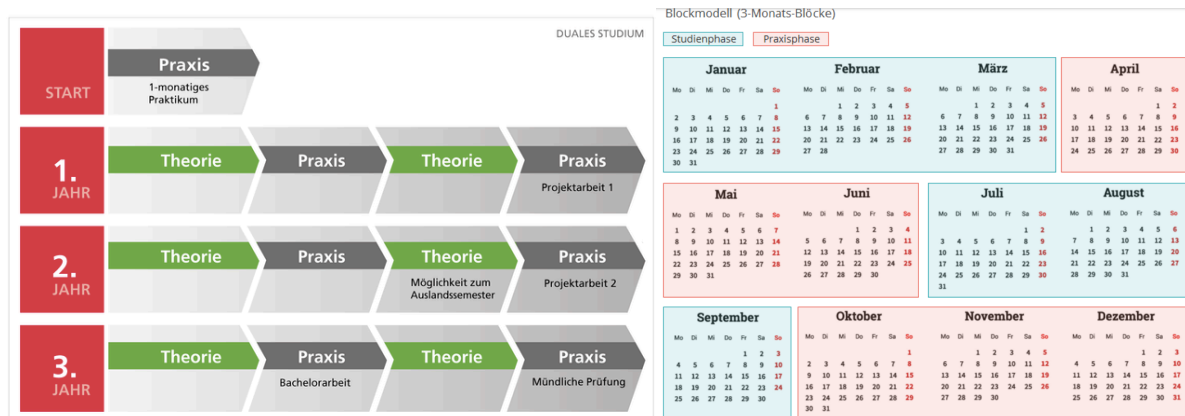
³² While regulation in the German HEI systems occurs through various forms and levels of accreditation, DHBW is – since 2011 – able to conduct internal review process, the ‘*Systemakkreditierung*’ (DHBW 2011).

³³ In addition to individual states’ laws governing higher education, requirements of the Standing Conference of State Ministers (KMK), and the procedures for programs and system accreditations staff representation structures are a mechanism through which high standards are assured at the university level. Meanwhile, on the operational side, the Vocational Training Act (‘*Berufsbildungsgesetz*’, BBiG) and the Trades and Crafts Code (*Handwerksordnung*, HwO) are of particular relevance – at least with regard to apprenticeship-integrating programs.

³⁴ The state law requires professors at universities of applied science to have at least five years of practical experience, three of which have to be outside the academic environment (Haug 2009).

form relationships and experience the atmosphere at a university as well as in the company. That being said, other HEI opt for different formats, including the *Rotationsmodell* (rotation model) and distance learning models with or without occasional presence phases at the place of learning (BIBB 2017).

Figure 4: Structure of Dual Study Programs at DHBW (practice and theory phases over the course of the entire program and in each calendar year)



Source: DHBW Stuttgart 2019.

At Wentworth Institute of Technology, by contrast, students are mostly instructed by full-time academic faculty. While the latter can also be active in their respective industries and/or remain practitioners, it is not a formal requirement for full-time professors to also have worked in industry.

While the latter can also be practitioners, work experience in industry it is not a formal requirement for full-time professors. Rather, the focus lies on of their teaching ability, the quality of their research, publications, and overall academic record.³⁵ Another major difference from the German system is the amount of time students at WIT spend at the university and in companies. Generally participating in only two (mandatory) co-op phases during the spring of the 3rd year and the fall of the 4th year respectively (see Figure 5), students face instruction with a strong academic bias. While they can voluntarily complete a third co-op during the summer following their sophomore year to gain additional work experience, earn income, and acquire insights into the functioning of and corporate dynamics in companies,³⁶ doing so is an optional activity, and not applied toward the graduation requirement. To ensure high levels of work-integrated education, WIT faculty rely on hands-on projects and lab sessions throughout the semester.

Figure 5: Structure of co-op degree programs at Wentworth University

Standard 4 Year Bachelor of Science
(Except: BSA, BELM & BSAM)

	Fall	Spring	Summer
1st Year	Classes	Classes	Off
2nd Year	Classes	Classes	Optional Co-op
3rd Year	Classes	Required Co-op I	Classes
4th Year	Required Co-op II	Classes	Classes

Source: Center for Cooperative Education and Career Development, Wentworth Institute of Technology 2019.

Assessment and examination

As in the instruction and training space, companies play a key role in the assessment and examination of students’ performance in the DHBW system, in particularly once students have acquired basic knowledge in key disciplines. Industry representatives thus oversee in-class projects, grade written reports, and conduct oral examinations. Companies also act in a capacity as mentors and student advisors and provide extensive feedback on students’ performance. Indeed, in the

³⁵ Occasionally, academic positions at WIT are also filled by retired practitioners, interested in pursuing teaching as a second career and way to stay engaged, while passing on knowledge and experience.

³⁶ This exception does not apply to students of Architecture, Applied Mathematics, and Electromechanical Engineering for which separate rules exist.

German WBHE and at DHBW in particular students rely largely on their professional supervisors, and consult with professors predominantly on academic matters.³⁷ This practice contrasts with that at Wentworth Institute of Technology, where the focus on the academic component and the dominance of the traditional professors results in their being in charge of measuring and assessing students' performance.

Also, with regard to the assessment of work in the practical phases of the program, DHBW and WIT differ considerably. At DHBW, companies have to provide extensive feedback on the quality of the work done by the trainee as they move across departments and units, whereas at WIT, performance during a co-op is assessed through a grade category ("satisfactory/unsatisfactory"), a self-evaluation and a short evaluation by the direct supervisor at the company site. While in both cases, companies may use the opportunity to distinguish themselves from others by providing better feedback and comment on both technical abilities as well as social skills, the very set-up of the assessment and examination component at DHBW and WIT reveals diverging fundamental priorities: Individuals attending DHBW have equal opportunities to learn about their work and themselves as students as well as employees and colleagues. Meanwhile, at WIT students receive extensive attention and feedback from their advisors and faculty members, but merely a small snapshot into how they will fare as workers. In the absence of an extensive report or numerical grade that could provide further insight into the quality of work done by WIT students, it is mostly their ability to obtain a position after graduation that serves as an indicator of their performance during the practical phases of their education. This form of indirect assessment is not without challenges, however, as fluctuations in the labor market and economy may prevent even well-performing candidates from acquiring a position upon completion of their studies.³⁸

Summarizing the observations made across the four categories addressed above, we find that at DHBW companies play a comparatively stronger role both in the design as well as in the implementation of WBHE programs than at WIT. Rather than a coincidence, this difference is a consequence of the specific ways in which the two institutions are set up and understand themselves: In line with its mission statement, "the participating companies and social institutions are involved as equal partners of the university" (DHBW 2015) at DHBW as is also evident in the university's organizational set-up, which promotes a close and continuous engagement among the different actors. While corporate partners also play an important role at WIT, the latter is organized in a way that stresses its status as an independent academic institution, with external-facing services being managed by separate, supportive units. Related to this observation is the fact that both universities are subject to rather different sets of rules and guidelines. While DHBW's operations are determined by a large number of procedures for program and system accreditation, self-administration, and staff representation structures, regulatory requirements in the US are

³⁷ In line with this observation, our interviews suggest that the quality of the mentorship that trainees receive at the company and the degree to which they are integrated into a team early-on are indeed crucial contributors for their success across the program.

³⁸ While the most appropriate way of comparing retention and integration into the labor market in both countries would be to look at how WBHE degrees perform in relation to graduates in the same subject who are enrolled in traditional programs, the absence of such data draws the author's attention to the different practices with which DHBW and WIT are involved in facilitating the job-finding process.

significantly weaker. As a consequence, WIT is significantly freer to decide how it organizes its operations and the collaboration with partner companies. In the last section of this paper, we will reflect on the implications of these differences in view of larger discussions about the skills needed in the future.

3. Reflections on WBHE and the ‘work of the future’

Our analysis has demonstrated that – despite the shared claim of promoting education and skills acquisition through the close integration of theory and practice – the two WBHE programs analysed in this paper operate in rather distinct ways.

A key difference relates to the relative engagement and influence of the various actors. While WIT maintains strong influence over the admission process, content creation and renewal, teaching practices, and assessment, DHBW is characterized by companies either taking on the key role in the first place (e.g. in the admission process), and/or making significant contributions throughout all of the aspects mentioned above. As a consequence, we can see a stronger focus on academic skills in the American institution, and a proliferation of more industry-specific knowledge in the German one. This difference is relevant as it is likely to affect the extent to and speed by which each of the WBHE programs can respond to shifts in the labor market and firm demands and, thereby, their overall attractiveness.³⁹

Moreover, the German and American system differ in the specific duties as well as financial responsibilities of the stakeholders involved: in the German case, trainees obtain a considerable part of their education by working in a company. The public covers the costs of the acquisition of academic knowledge at the university, but leaves it to corporations to pay for the practical training component. Meanwhile, co-op programs at WIT and other four-year colleges in the US depend first and foremost on the ability and willingness of students (or their families) to pay for education and training.⁴⁰ Despite the availability of grants and scholarships and the social mission which many US HEI ascribe to, enrolling in a WBHE system thus still requires considerable resources, and thereby faces the same kind of challenge as the traditional university education in terms of providing a viable path for greater access and equity.

In Germany, strict regulatory guidelines and public oversight have furthermore ensured a comparatively high degree of transparency among WBHE programs and, thereby, the rapid proliferation of dual study degrees and a generally positive attitude towards work-based learning. In the United States, by contrast, few regulations and official standards exist to ensure a consistent quality among programs and institutions in the design and implementation of co-op programs. While individual learners and firms may appreciate the flexibility this situation allows for, it also requires both groups to invest significantly more time and resources into navigating the WBHE space. The argument that this enables a better match between the expectations of the different groups and reduces the number of students who leave college prematurely cannot be validated in light of the absence of data about why students do not choose to complete their degrees in both countries. The counterargument, however, suggests that increased complexity puts an additional burden on potential students, and may especially affect individuals from a lower socioeconomic background negatively.

³⁹ We recommend that future research test how this hypothesis affects different industries and companies of various sizes.

⁴⁰ While universities or other actors may provide support through grants and tuition assistance, and companies pay a salary for services rendered during the co-op phases, students face the vast amount of expenditures.

In summary, we find that the potential of WBHE as an educational pathway to train the ‘workforce of the future’ is currently underexplored, especially in the US. In order for this to change, efforts should be made to increase awareness by promoting greater transparency and visibility of programs. Minimum quality standards and new funding models could help this cause further. The German system, by contrast, could benefit from the greater ability of HEI in the US to distinguish themselves from others through a unique organizational set-up. In both countries, a greater emphasis should be put on enabling upskilling and retraining through continuing education.

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