



Future skills

Six approaches to close the skills gap

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Summary

According to estimates, in five years there will be a shortage of 700,000 people who possess technological skills such as complex data analysis or web development in Germany. There is also predicted to be a skills gap of 2.4 million employees with the necessary cross-disciplinary skills. These are alarming figures considering how important technological and cross-disciplinary skills are in preparing for a rapidly changing workplace and to ensure continued participation in society.

This paper analyzes over 30 current initiatives in Germany dealing with future skills. The analysis reveals challenges in the education system that prevent the future skills gap from being closed—there is a lack of transparency in future skills training, future skills content is lacking in schools and universities, and there is no systematic further training of future skills at the workplace.

Examples from other countries such as Estonia, Finland, China and Singapore, and indeed from Germany, offer inspiration for six concrete approaches to bridge the looming future skills gap. To create transparency for example, a future skills online platform could be established with an integrated future skills tracker that reveals what skills users lack and where they can find training; schools and universities could integrate future skills teaching concepts and materials in their lessons; and businesses could be offered financial incentives to introduce more future skills training in their companies.

Digitization and automation are bringing about vastly changing requirements at the workplace, and will also be increasingly important for continued participation in society. Future skills¹ are needed now—skills that to some extent already exist today like agile working and digital interaction, and also skills that are only just emerging like blockchain technology development, all of which will become considerably more important tomorrow. As it currently stands, 25 percent of today's workforce will either need to find new professional activities by 2020 or significantly broaden their technological skills as well as their digital citizenship and classic skills—i.e., their cross-disciplinary skills². These skills include programming, agile working, and adaptability. Even elementary school students need to get ready for the change, since by 2030, 85 percent of them will work in professions that do not yet exist³.

Previous papers on future skills have identified 18 future skills, and shown that the future skills gap—i.e., the number of underqualified workers—will rise to 700,000 for technological skills in the next five years, and to as much as 2.4 million for cross-disciplinary skills. This discussion paper proposes methods that Germany can implement to close the future skills gap as quickly and in as targeted a way as possible. The various papers on future skill have been developed with the Stifterverband für die Deutsche Wissenschaft, a German non-governmental organization seeking to address challenges in higher education, science and research. Founded in 1920, major donors include most major German corporations, but also > 2,000 medium-sized companies.

1 See the Glossary at the end of this paper for a definition of terms

2 Welt: "So soll Deutschland digital in die Gänge kommen" (2017)

3 Netzwoche: "Die meisten Berufe des Jahres 2030 gibt's noch gar nicht" (2017)



A man with a beard and glasses, wearing a blue and white striped sweater, is sitting at a wooden desk. He is looking down and to the right, with his hand resting on his chin in a thoughtful pose. On the desk in front of him is a silver laptop keyboard and a black pen holder containing several pens. The background is a blurred office setting with a window. A large blue diagonal overlay covers the left side of the image, containing the title text.

The three greatest challenges in Germany's future skills training

This discussion paper assessed the effectiveness of over 30 existing initiatives intended to close the future skills gap. The analysis shows that there are still significant challenges when it comes to the development of future skills needed to close the current gap, particularly in three action areas—establishing underlying transparency for future skills training, in the first education system (schools and universities), and in further training for future skills (second education system).

There is a lack of underlying transparency regarding future skills training options:

As early as 2008, the GEW, IGM and Ver.di unions highlighted how the effectiveness of training was hindered by the lack of transparency over training offers. This is particularly the case when it comes to further training. For example, in Germany, a central search engine for further training courses (Suchmaschine des Deutschen Bildungsservers für Weiterbildungskurse) allows people to search for training courses⁴. However, with such a huge number of training courses from some 22,000 providers⁵, the available options are virtually impenetrable. Take the search term “Big Data” for example: This returns 6,377 results from 193 providers with courses starting from July 2018 at political levels ranging from federal government to local authorities. Users would be forced to spend several hours comparing the courses before finding a suitable option for them. A further problem is that many users do not actually know what their own level of future skills is; in fact, they are not even entirely sure which skills are relevant, which makes it all the harder to find the right course.

The first education system offers opportunities to develop future skills, but these are not enough:

It is true that there is a wide range of initiatives aimed at integrating digitization in schools and universities such as DigitalPakt Schule, an initiative of the federal government and states, the “Bayern Digital II” master plan, and the Digitale Dividende II in Hesse (see Table 1). However, it is clear that the current education programs for pupils and students are still not focused enough on the needs of the future labor market. To take just one example, despite the fact that in five years the labor market will lack 700,000 workers with technological skills, in one German state only 3,000

hours of IT lessons were offered in 2016. By comparison, there were 15,000 hours of Biology lessons⁶. Of around 630 schools in this state, only 98—just 15 percent—offered an IT course⁷. Although the percentage is higher at national level in Germany, other EU countries are already a step ahead. In the U.K. and France for example, Programming is already part of the curriculum in all elementary schools⁸. Although Germany is working hard to strengthen its IT curriculum with initiatives such as the above-mentioned “Bayern Digital II” master plan, such IT courses alone will not be enough as they do not cover the full spectrum of necessary technological skills like complex data analysis and tech-translation.

Despite the existing offerings, there is still no systematic future skills further training structure:

Gaps also exist when it comes to further training in future skills. According to a survey conducted by the McKinsey Global Institute, 75 percent of companies asked believe that further training for their employees is indispensable in filling the future skills gap. Indeed, at current levels, only 11.4 million people are sufficiently qualified in cross-disciplinary skills even though 22 million workers will be needed with these skills in five years⁹. And although there are already initiatives underway to bridge the current gap, such as the establishment of Training Factories 4.0 as part of digital@bw or the information portal digitales.nrw (see Table 1), an analysis of the current initiatives shows that the German state could offer somewhat more concrete offerings or incentives for further training in the area of future skills. Funding guidelines like “Zukunftsfähige Unternehmen und Verwaltungen im digitalen Wandel” [Future-ready businesses and administrations in digital change] published by the Federal Ministry of Labor and Social Affairs are generally only advisory in nature. Other measures that focus on further training are often just research projects such as “Fachkräftequalifikation und Kompetenzen für die digitalisierte Arbeit von morgen” [Specialist qualifications and skills for the digitized work of tomorrow]. As such, Germany has huge potential to establish itself as a destination for further training.

4 <https://www.iwwb.de>

5 Federal Institute for Vocational Education and Training: “22.000 Weiterbildungsanbieter sichern flächendeckende Versorgung” (2014)

6 Spektrum: “Informatikunterricht an NRW-Schulen ist eine Randerscheinung” (2016)

7 <https://www.schulministerium.nrw.de/BiPo/SchuleSuchen/online?action=594.6296818782946>; <http://www.schulliste.eu/type/gymnasien/?bundesland=nordrhein-westfalen>

8 Euractiv: “Coding at school – How do EU countries compare?” (2015)

9 Own data/extrapolation

Table 1: Selection of future skills initiatives in Germany

#	Political Level	Initiative	Details	Term
1	Federal government	Zukunftsfähige Unternehmen und Verwaltungen im digitalen Wandel [Future-ready businesses and administrations in digital change]	Under certain prerequisites, the Federal Ministry of Labor and Social Affairs offers companies and administrations financial support to establish training and practice facilities. In turn, the findings from these facilities are intended to help develop innovative solutions for shaping the digital workplace	To run from early 2018 through to late 2020
2	Federal government	Research initiative "Fachkräftequalifikation und Kompetenzen für die digitalisierte Arbeit von morgen" [Specialist qualifications and skills for the digitized work of tomorrow]	This research initiative examines how 14 occupations that are affected by digitization are changing in terms of work processes, activities, and qualification requirements	Ran from 2016 to 2018
3	Federal government	Digitale Arbeitswelt [Digital workplace]	A report focusing on how a qualification and further training strategy within the federal government and between the federal government and states can be developed together with business and trade unions in the long term to leverage the potentials of digitization	Published 2016
4	Federal government	"Lebensbegleitende Berufsberatung" [Lifelong career advice] from the Federal Employment Agency	Advice on individual career planning or reorientation and new qualifications in the context of social progress (piloted in Düsseldorf and elsewhere)	Running since 2017
5	Federal government/ States	DigitalPakt Schule	DigitalPakt Schule incorporates numerous initiatives of the federal government and states: Government assumes investment costs for the technical infrastructure of schools; federal states assume responsibility for training teachers, adjusting curricula, procurement and maintenance of teaching programs and other software, and ensuring the operation and maintenance of the infrastructure	Approval planned for end of 2018
6	State (Bavaria)	"Bayern Digital II" master plan	Introduction of a "digital classroom" in schools, reinforcing IT lessons in secondary education, further training offensive for teaching staff, better IT equipment for schools, investment of EUR 280 million into artificial intelligence research, and so on	Running from 2018 to 2022
7	State (Hesse)	Digital Dividend II	Providing grants to schools to encourage broadband expansion. Every school authority can apply for a grant to expand fiber optic networks	Running since 2015
8	State (Hesse)	ProAbschluss	Consultation offering for further training to prepare employers for the growing requirements of the increasingly digitized workplace. The scheme provides the opportunity to review the necessary qualifications, with the state contributing up to half of the further training costs up to a maximum of EUR 4,000	Running from 2016 to 2021
9	State (Baden-Württemberg)	digital@bw	Training Factories 4.0 for apprentices and attendees on further training courses: Laboratories that mirror the layout and equipment of industrial automation solutions to train participants in the basics of the technologies and processes used	Running since 2017
10	State (North Rhine-Westphalia)	digitales.nrw	Portal with information and networking offers covering Economy and Work 4.0 for SMEs and employees in NRW	Running since 2018





Inspiration from home and abroad— how Germany can bridge the future skills gap

To bridge the future skills gap, politicians need to take a targeted approach to addressing the current challenges. To do so, they must set the necessary frameworks to allow businesses and education institutes to access future skills initiatives. Politicians must follow three strands in particular: Build transparency in future skills education and further training, strengthen the first education system with future skills content, and further expand the future skills further training system (second education system).

Examples from home and abroad offer inspiration for possible approaches to close the future skills gap. We have assessed these examples and refined them to create a basis for discussing ways to develop future skills in Germany (Graphic 1).

1. Introduce a central future skills online platform

Good example: To establish transparency over the skills profiles of students and graduates, the U.S. platform Portfolium allows users to supplement their resumes with examples of skills and share these with employers. Using this concept, Portfolium has been able to reach over 3.75 million students and 50,000 employers¹⁰.

Approach for Germany: In a similar vein, the federal government could offer an interactive future skills online platform where users could not only measure their future skills, but also determine which future skills are particularly in demand and find tailored training offerings. By taking in-built tests using the future skills tracker, users could evaluate their development in technological and cross-disciplinary skills, thus gaining further transparency over possible future skills development potentials. They then receive a personalized overview of training programs that match their existing skills to prepare them in the best way possible for future working conditions.

2. Introduce technological skills teaching materials and concepts in schools and universities


Good example: Schools and universities in China already tailor their lessons to the demand for technological skills in future society. Many of their education institutes receive teaching materials for technological skills such as the textbook “Fundamentals of Artificial Intelligence”. This is currently being introduced to teach China’s students cross-disciplinary skills in the area of artificial intelligence¹¹. And in the USA, some primary and secondary schools integrate practical exercises on

GRAPHIC 1: SIX APPROACHES FOR GERMANY TO CLOSE THE FUTURE SKILLS GAP

Aim for 2023: Close the future skills gap of 700,000 in technological skills and 2.4 m in cross-disciplinary skills			
Dimensions	Approaches		
Create transparency	<p>Central future skills online platform Users can measure and share their future skills, and find tailored training programs</p>		
Strengthen the first education system (schools and universities)	<p>Technological skills teaching materials in schools and universities The state funds coordinated teaching materials for technological skills at various qualification levels</p>	<p>Cross-disciplinary teaching concepts in schools and universities Introduce self-developed future skills teaching concepts to provide students with cross-disciplinary skills rather than providing subject-specific teaching</p>	<p>Future skills research hubs per technological skill Establish excellence hubs for technological skills (eg: hub for complex data analysis) at universities</p>
Expand second education system (further training)	<p>Future skills further training for all employees A clause could be introduced to employment contracts for example, requiring employees to develop future skills during their working hours every three years</p>	<p>Financial incentives to develop future skills Citizens over the age of 30 could receive an annual further training allowance of EUR 500 to be used on certified future skills programs</p>	

10 <https://www.crunchbase.com/organization/portfolium#section-overview>

11 South China Morning Post: “China looks to school kids to win the global AI race” (2018)



Finnish schools are committed to giving more prominence not just to technological skills, but also digital citizenship and classic skills.

Finland, which is often seen as a role model for education measures thanks to its remarkable results in school performance studies, wants to introduce project-based learning instead of classic Mathematics and History classes across the country by as early as 2020. The idea is to familiarize students with collaborative working and expand their problem-solving skills.

technological skills into their lessons, such as exercises on web development in numerous subjects including Chemistry and even History¹².

Approach for Germany: German schools and universities could today integrate technological skills into lessons across all subjects. One option would be for the federal states to give schools the freedom to shape their own learning programs regarding which technological skills are integrated as visible learning components in lessons. For example, instead of English classes, they could introduce a bilingual programming lesson¹³; robotics exercises could be integrated in existing curricula, for example, constructing small machines in Geography lessons that take earth samples, and new future skills courses could be offered. Under this framework, technological skills teaching materials that are tailored to the various qualification levels must be funded by the government. Dovetailing technological skills with current education formats ensures that future skills will be applied in a practical way.

3. Introduce cross-disciplinary teaching concepts in schools and universities

Good example: Finnish schools are committed to giving more prominence not just to technological skills, but also digital citizenship and classic skills. Finland, which is often seen as a role model for education measures thanks to its remarkable results in school performance studies, wants to introduce project-based learning instead of classic Mathematics and History classes across the country by as early as 2020. The idea is to familiarize students with collaborative working and expand their problem-solving skills¹⁴.

Approach for Germany: One approach for Germany could be for schools and universities to introduce project work methods and self-developed future skills teaching concepts to teach students cross-disciplinary skills such as agile working and entrepreneurial thinking instead of just learning in a subject-specific way. The government and states could support education institutes by providing drafts of teaching concepts and promoting the exchange of “best practices” between schools and universities. For example, teams of four students could be put together to develop, test, implement, and iteratively improve a concept for a website or History presentation. Innovative teaching concepts can increasingly be supplemented with skills-based

tests, where pupils and students solve practical tasks by programming an app for example. Furthermore, participation in external future skills training offerings could be used to help students achieve school leaving qualifications and degrees—providing the incentive to proactively develop their future skills away from lessons.

4. Establish future skills research hubs

Good example: To ensure research into future skills—a fundamental prerequisite in ensuring excellence in teaching—is promoted in addition to learning, the Frankfurt School of Finance & Management founded the Frankfurt School Blockchain Center in 2017. The Center is devised as a think tank and research center, and studies the implications of blockchain technology for businesses and administration. The Center also acts as a knowledge sharing platform for decision makers from start-ups and technology and industry experts.

Approach for Germany: This Center should be the inspiration for new excellence hubs at universities set up by the federal states to promote technological skills (e.g., a hub for complex data analysis or to develop smart hardware and robotics). These hubs would form a universal framework for disruptive technologies and provide new, cross-disciplinary research impetus. Fellowships would be granted to professors and junior professors to engage in research into future skills or to found new future skills. The future skills hubs also act as a key interface of science and business: The government could provide funds that could only be accessed if businesses work together with the hubs, for example by supporting individual research work or hackathons.

5. Enable future skills further training for all employees

Good example: In Germany—and internationally—there are still too few systematic initiatives for future skills further training. One of the few examples is the following: A large German corporation offers its employees up to one working day a week to freely develop their further training in future skills within the company—skills such as data analysis using Excel or expertise in renewable energies¹⁵.



Approach for Germany: Germany could become a pioneer of a nationwide initiative in this respect. The government could introduce a measure under which employment contracts state that employees must

12 Communications of the ACM: “Scratch: Programming for All” (2009); The Conversation: “Why schools need to introduce computing in all subjects” (2016)

13 To successfully implement this proposal, a sufficient supply of IT teachers is necessary, which must first be established in Germany

14 BBC: “Could subjects soon be a thing of the past in Finland?” (2017)

15 Expert interviews with company representatives



develop their future skills every three years at full-time equivalent working hours on an in-house intensive course or an external course such as at a university. Equally, it would be feasible to introduce a ruling under labor law for a continuous model based on the example of the above-mentioned German corporation. Alternatively, the government could introduce a future skills take-time. This would replace the current training leave and instead offer employees annual leave of 80 working hours to engage in targeted further training in future skills (e.g., tech-translation or digital literacy). Under this concept, employees would be able to integrate the allotted leave into their working week (e.g., two hours every week) to ensure regular and continuous training. This “off-the-job” training must also be continued in concrete “on-the-job” projects that employees work on within their respective roles. Both components are important elements and need to be well coordinated with each other.

The public sector could act as a pioneer of further training in future skills with a strong focus on future skills for teaching staff in particular. At least 50 percent of professional further training plans could be replaced with future skills. In this way, teaching staff learn how to use future skills while retaining their educational freedom. Employees in the private sector could agree future skills further training measures with their employer, which they then pilot in training and practice rooms. The Confederation of German Employers’ Associations (Bundesvereinigung der Deutschen Arbeitgeberverbände) also advocates such freedom when it comes to shaping new learning environments¹⁶.

6. Create financial incentives for the development of future skills for businesses and freelancers

Good example: As an incentive to encourage private individuals to take up further training, Singapore’s Ministry of Education offers all citizens over the age of 25 an allowance of SGD 500 that they can use to spend on subsidized courses in future skills such as web development. This financial incentive to enroll on certified courses is intended to help citizens continue with lifelong professional training¹⁷. In total, 285,000 Singaporeans have taken advantage of these courses in the past two years. The Canadian government also offers companies financial incentives to drive forward further

¹⁶ Federal Ministry of Labor and Social Affairs: “Arbeiten 4.0: Bundesarbeitsministerium startet Experimentierräume” (2017)

¹⁷ SkillsFuture Singapore: “Reimagining our future workforce” (2017); The Straits Times: “Singapore Budget 2015: Every Singaporean above 25 to get \$500 for a start under SkillsFuture” (2015)

training. The ‘Canada-Ontario Job Grant’ program offers businesses CAD 10,000, which they can invest in training for complex data analysis or agile working¹⁸.

Approach for Germany: A host of financial incentives could also be set up in Germany. One option—similar to the Singapore example—would be for the government or states to introduce a future skills allowance. Citizens over the age of 30 receive an annual further training allowance of EUR 500 to be used on certified future skills programs. Since technological skills and, in particular, cross-disciplinary skills will affect all professional sectors in the future, future skills further training courses could in future also form a financial investment for all businesses and freelancers and be made tax deductible. This would provide the necessary impetus to make further training the norm for companies.

Implementing these proposals provides the drive needed to close the future skills gap permanently. According to initial estimates, the expected annual cost is around EUR 5 billion¹⁹, of which the introduction of future skills further training for all employees (laid down as a ruling in employment contracts stating that employees must take up further training every three years) would assume the greatest share with EUR 2.5 billion. Currently, the costs for education measures are

predominantly assumed by the federal states, with the federal government also assuming some costs. In a similar way to the current split, the government could assume around 10 percent of the costs for the proposed measures and the states and local authorities around 90 percent²⁰. The economic benefit of closing the future skills gap is huge—several billion euros according to one estimate.

Germany faces the challenge of closing the gaps in technological skills for 700,000 people and in cross-disciplinary skills for 2.4 million. Politicians can take this opportunity to seek inspiration from the examples of various countries to devise their own initiatives for future skills education and training with three aims: Create transparency to help citizens get information about tailored education and training offers; strengthen the first education system, which should be tailored to the needs of a future labor market; and expand a second education system specifically focused on future skills to support lifelong learning. It is incumbent on politicians to set the necessary impulses to ensure pupils, students and employees are and remain fit for the labor market of the future.

18 Ontario Ministry of Training, Colleges and Universities: “Canada-Ontario Job Grant Program” (2018); Invest in Ontario: “Government grants, loans, tax credits and support services for Ontario businesses” (2018); Next-Steps Employment Centres: “How to access Government Grants and Hiring Incentives” (2016)

19 Central Future Skills Online Platform: EUR 15 million with a reach of one million users (derived from costs for the eTwinning and The School Education Gateway platforms); technological skills teaching materials and cross-disciplinary teaching concepts in schools and universities: EUR 1.1 billion from EUR 500 for teaching materials over five years (i.e., EUR 100 each year) for all pupils and students (i.e., 8.35 million pupils and 2.8 million students); future skills research hubs for each technological skill: EUR 525 million. On average, three hubs are established per technological skill, each at a cost of EUR 25 million (derived from costs for the Swiss Data Science Center); future skills further training for all employees: 1) EUR 2.5 billion with 37.1 million employees taking one week’s further training in digital and instructor-led programs every three years at an average course cost of EUR 200 (derived from a combination of pay-per-use courses for digital skills and e-Learning courses at the IIK Düsseldorf). 2) EUR 25 million with 50,000 individuals taking advantage of future skills take-time and EUR 500 course costs for 10 days (derived from a one-week e-Learning course at IIK Düsseldorf); financial incentives for developing future skills: 1) EUR 111 million tax loss each year from annual 15 percent corporation tax deduction for EUR 200 courses for 3.7 million employees. 2) Total future skills allowance of EUR 500 million if one million people use the allowance each year.

20 Standing Conference of the Ministers of Education and Cultural Affairs: “Das Bildungswesen in der Bundesrepublik Deutschland 2014/2015” (2015)

Glossary

Future skills: Skills that will become more important for professional work and/or participation in society in the next five years—across all industries and not just in individual branches

Technological skills: Digital skills that characterize new professions, and are being practised by ever more employees. Those who have mastered these skills have the latest (information) technology expertise and can apply it. These skills will create new job profiles across all organizations. They already underpin many job profiles in today's start-ups

Digital citizenship skills: Digital skills that everyone will need in their professional lives and to participate in society. Those who have mastered these skills can work in collaborative and agile teams, and make critical decisions in an increasingly digital world. These skills will be needed by everyone in the future—not just at work, but also to participate in society

Classic skills: Classic skills that everyone needs in their professional lives and to participate in society. Those who have mastered these skills can cope with new situations and solve problems with their own ideas. These traditional skills will become even more important in future as responsibilities and job profiles rapidly change due to automation and digitization

Cross-disciplinary skills: Cross-disciplinary skills is an umbrella term for digital citizenship skills and classic skills, whereas the technological skills refer to specific technical skills



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