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New fields for apprenticeship

Insights for successful expansion of apprenticeships to new sectors and occupations

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The **European Centre for the Development of Vocational Training** (Cedefop) is the European Union's reference centre for vocational education and training, skills and qualifications. We provide information, research, analyses and evidence on vocational education and training, skills and qualifications for policy-making in the EU Member States. Cedefop was originally established in 1975 by Council Regulation (EEC) No 337/75. This decision was repealed in 2019 by Regulation (EU) 2019/128 establishing Cedefop as a Union Agency with a renewed mandate.

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Foreword

When apprenticeships are well-designed and seamlessly integrate education and the labour market, they can be a particularly effective tool to enable individuals to gain the skills and qualifications they need in today's economies and societies. Various EU Member States and Organisation for Economic Co-operation and Development (OECD) member countries have seen a considerable expansion of apprenticeships in recent years. Some countries have made substantial investments in their apprenticeship system, promoting apprenticeship as an effective and inclusive strategy for fast-tracking employment in high-demand careers. Existing apprenticeship schemes have been reformed, for example to make them more flexible, and new schemes have been introduced.

On many occasions, expansion has meant expanding apprenticeship provision to fields, sectors or occupations that were previously not typically covered by apprenticeships, such as information technology, healthcare and teaching. In some cases, the expansion to new fields has also led to the introduction of apprenticeship programmes at higher levels of education, such as graduate apprenticeships in Scotland (United Kingdom).

On 1 and 2 April 2025, the fourth European Centre for the Development of Vocational Training (Cedefop) / OECD symposium, 'New Fields for Apprenticeship', presented evidence from around the world regarding this expansion of apprenticeships to new fields. This publication represents a collection of the symposium papers and captures the experiences of such expansion efforts, drawing useful lessons on the objectives, the processes followed and the outcomes of such initiatives. The papers document that apprenticeship can be a suitable education and training option to offer the skills and qualifications needed in these new sectors. New programmes bring significant benefits to participating learners (either young people or adults) and training companies both during and after the completion of programmes, but also to whole sectors, local communities and states. Such expansion can be driven by various actors and is more likely to succeed if it is based on broader stakeholder engagement. Many papers stress that high-quality learning and access to formal qualifications are key to a new programme becoming an established option. Other notable success factors that are highlighted are the existence of sufficient, well-trained teaching and training staff in these new sectors and the pre-existing perceptions about the attractiveness of these sectors and apprenticeships overall.

This publication therefore provides policymakers with valuable insights from research from around the world and supports better-informed decisions regarding the expansion of apprenticeship offerings into new sectors and occupations, potentially with different education levels and learner groups.

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The publication originates from the fourth joint Cedefop/OECD symposium, 'New Fields for Apprenticeship', which was held on 1 and 2 April 2025 in Paris. Cedefop and the OECD would like to thank all the authors of the papers included in this publication, who presented their work at the symposium.

Vlasis Korovilos (Cedefop) and Marieke Vandeweyer (OECD) organised the symposium and acted as editors of this publication. Ricardo Espinoza (OECD) co-authored the executive summary. We are grateful to colleagues Tara Byrne (OECD) and Christina Karkanti (Cedefop) for their contribution to the symposium and publication.

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Executive summary

Introduction

Since 2019, the European Centre for the Development of Vocational Training (Cedefop) and the Organisation for Economic Co-operation and Development (OECD) have been exploring external megatrends affecting apprenticeship design and implementation, including how changing labour market needs of the expansion of apprenticeship programmes to new occupations, education levels or target audiences.

Against the backdrop of the COVID-19 crisis, in addition to the European Green Deal (2019) and the 2021 OECD Ministerial Council Statement, which prioritise facilitating a green, inclusive and resilient recovery for all, the Cedefop/OECD symposium (2021) and publication on the role of apprenticeships for greener economies and societies (2022) offered further evidence that new apprenticeship programmes emerge as a response to skills gaps and shortages in sectors such as renewable energy; energy and resource efficiency; renovation of buildings; construction; environmental services; and manufacturing.

The subsequent symposium (2023) and publication on apprenticeships and the digital transition (2024) shared more evidence on programmes in sectors such as software development, data science, user experience design and cybersecurity. Apprenticeship was increasingly seen by employers in the digital sector as a strategy to address acute skills gaps, while the digital sectors also emerge as an attractive option for prospective apprentices, both young people and adults.

Recent OECD evidence (2025) shows that rapid shifts linked to the digital and green transitions are creating a strong demand for specialised skills, and in many sectors the need for skilled workers already exceeds the supply. This strengthens the role of apprenticeships as accessible pathways that both combine learning and earning and offer reskilling opportunities for adults. For employers, apprenticeships provide a sustainable way to develop talent and address persistent skills shortages.

Although apprenticeships are still often associated with traditional crafts and trades, many countries are expanding provision into new sectors such as software development, data science, design and digital product development. This shift is diversifying the profile of apprentices, increasing participation among adults and under-represented groups, and improving labour market outcomes through stronger links between training and employment.

The Cedefop Skills Forecast for 2035 shows that the twin transitions, together with demographic challenges, will continue to drive the demand for high-level skills. According to the forecast, at the sectoral level, high-tech industries and those related to science, technology, engineering and mathematics, including computer programming, and architectural and engineering industries, are expected to be among the industries with the highest employment growth. The green transition will drive employment declines in coal mining and fuel manufacturing, while electricity-related jobs are projected to increase. At the occupational level:

(a) strong employment growth is forecasted for information and communications technology (ICT) professionals and technicians, and science and engineering roles, all of which require advanced digital skills;
(b) health-related occupations (e.g. health professionals, personal care workers) will expand to address demographic challenges;
(c) the highest numbers of job openings are expected for business and administration professionals and associate professionals; teaching professionals; personal service workers; and science and engineering professionals;
(d) other high-skilled occupations with high employment growth include legal, social and cultural professionals.

Short-term projections of employment by occupation give a similar picture. Cedefop's short-term anticipation of skills trends and VET demand (STAS) tool data show that, for 2026, the highest growth is expected for professionals in ICT; business and administration; legal, social and cultural occupations; health; and science and engineering. Cedefop's latest European Skills and Jobs Survey underscores the impact of digital technologies on job skills and continuing vocational training, shedding light on shifting skills demands, emerging job profiles and widening gaps, particularly in artificial-intelligence-driven and digital-intensive sectors.

In this context, adaptation of apprenticeships to these changing labour market needs is both expected and required. To study the expansion of apprenticeships to such new fields in greater detail, Cedefop and the OECD launched a call for papers on the topic in 2024, which resulted in a joint symposium on new fields for apprenticeships (2025). The intention was not only to capture the range of occupations for which apprenticeship is rapidly becoming a prominent education and training offer, but also to understand the process of introducing such initiatives and their design, the challenges in implementation, and the uptake of the new offers by employers and learners. The present publication brings these papers together.

Box 1. **What is meant by apprenticeships?**

In the 2019 joint symposium on the next steps for apprenticeships, and the subsequent publication, it was noted that the increase in apprenticeship enrolments and the emergence of new programmes may pose challenges in relation to what constitutes an apprenticeship and if the core features of an apprenticeship are being set in place and put in motion for the benefits for learners, employers and societies. Since then, attention has turned to reinforcing and consolidating the core features of apprenticeships as a unique education and training option, and to safeguarding their quality. Not all initiatives to introduce or reinforce work-based learning in vocational education and training programmes would fall under the category of apprenticeships as they are widely understood. Both the Council recommendation on a European framework for quality and effective apprenticeships (2018) and International Labour Organization (ILO) Recommendation 208 (2023) set criteria or provisions for high-quality apprenticeships and aid understanding of the term.

Council recommendation on a European framework for quality and effective apprenticeships (2018)

… apprenticeships are understood as formal vocational education and training schemes that

(a) combine learning in education or training institutions with substantial work-based learning in companies and other workplaces,

(b) lead to nationally recognised qualifications,

(c) are based on an agreement defining the rights and obligations of the apprentice, the employer and, where appropriate, the vocational education and training institution, and

(d) with the apprentice being paid or otherwise compensated for the work-based component.

ILO Recommendation 208 concerning quality apprenticeships (2023)

(a) the term 'apprenticeship' should be understood as a form of education and training that is governed by an apprenticeship agreement, that enables an apprentice to acquire the competencies required to work in an occupation through structured and remunerated or otherwise financially compensated training consisting of both on-the-job and off-the-job learning and that leads to a recognized qualification; …

For the purpose of the 2025 Cedefop/OECD symposium and this publication, 'new fields' refers to fields, sectors or occupations (or as a consequence specialties and programmes) that were not previously typically covered by apprenticeships. These might be entirely new (i.e. apprenticeship programmes are being offered for the first time in the studied sector or occupation) or they might have previously had very low levels of enrolment/participation but are becoming more central to apprenticeship-related

policies and individuals' choices.

Such 'new fields' may vary among countries. In countries where apprenticeships are the prominent vocational education and training option, the range of programmes offered through apprenticeships is much wider than in countries where apprenticeships have traditionally been linked to a specific set of craft or skilled trade occupations. For example, apprenticeships in information technology (IT) might have been a more established offer in the former set of countries, whereas they represent a novelty in the latter. Therefore, what represents a 'new field' depends on the national context, and such fields may include health; business and administration; financial services; sales and marketing; design; and the ICT/digital sector. In addition, especially in the light of the digital and green transitions, new programmes may emerge in more traditional sectors (e.g. construction, crafts, food, hospitality/tourism), for example in the professions of wind turbine technicians and photovoltaic installers.

Summary of papers

The papers included in this collection draw evidence from EU Member States and other OECD member countries, namely Canada, the United Kingdom and the United States. The examples presented in this publication refer to a wide range of occupations, including tech and digital; teaching; insurance; healthcare; and even some that would be considered traditional occupations but were not offered through apprenticeships in the countries in question (e.g. winemaking, scaffolding). Not surprisingly, the sectors included in the papers largely mirror those listed in the Cedefop Skills Forecast for 2035.

The papers refer to programmes offered to both young people, typically at the level of upper secondary education (European qualifications framework (EQF) level 3 or 4), and adults, at the post-secondary or tertiary level (EQF levels 5–8). This variety of new occupations and levels at which the programmes are offered reaffirms the key observation that prompted Cedefop and the OECD to study this topic: apprenticeship is increasingly opening up to new sectors and occupations, often by reaching new learner groups at different education levels.

An initial consideration for policymakers is whether apprenticeship is a suitable education and training option for new sectors associated with digital skills or service sectors based on high skill levels.

In Chapter 1, Anna Clara Gatti and Mauro Pelucchi investigate the expansion of apprenticeship models into high-growth, non-traditional sectors such as cybersecurity, educational technology and financial technology (Fintech). The research combines big data analytics, to extract skill requirements from online job postings; natural-language-processing techniques, to map postings against the Lightcast open skills taxonomy; and generative artificial intelligence, to measure the success factor of each skill. All three examined sectors have an evolving landscape in terms of the mix of technical and soft skills required, many of which can be developed successfully in workplace settings, making apprenticeship a highly suitable opportunity that offers the combination of theoretical knowledge and practical experience. Therefore, the paper suggests that apprenticeships, traditionally associated with more manual or technical trades, are increasingly relevant in sectors requiring a combination of advanced technical and soft skills, such as those of cybersecurity, educational technology and Fintech.

The paper by Bryan Coyne et al. (Chapter 2) seeks to understand the effectiveness of Ireland's first non-traditional degree apprenticeship model: that of insurance practitioner apprenticeships at higher education levels. Results suggest that the degree apprenticeship model offers a significant benefit to all stakeholders – graduates, employers and current apprentices. The research shows that employers consider that the apprenticeship programme offers a defined career pathway that allows them to plan strategically for the long term, which is greatly valued. They also note that the apprenticeship programme reduces onboarding and training costs, while raising the industry profile. A key benefit cited is the application of academic knowledge, which benefits the company in real time. Apprentices also benefit greatly from the apprenticeship programme: strikingly, their average earnings reach the national

average wage only three years after graduation. Moreover, the degree apprenticeship represents a cost-effective higher education pathway, improves access to higher education for mature students and fosters diversity and accessibility.

Expansion in such sectors does not only help employers address pressing shortages or invest with a view to achieving higher productivity in the medium term. It also brings tangible benefits to learners, both during their apprenticeship learning and after graduation, while apprenticeships can also be used as a vehicle to improve inclusiveness and opportunities for people who could not have easily accessed similar education and training offers, especially at higher education levels.

The paper by Ella Taylor-Smith, Sally Smith and Khristin Fabian (Chapter 3) examines the experience of the introduction of degree apprenticeships (at higher education levels) for computing in Scotland, mostly from the apprentices' perspective across the timeline of the apprenticeship (year 1 to final year), combining evidence from various studies conducted since 2017. Apprentices reported that they quickly became useful employees, for example as software testers, and benefited from gaining new skills, even when their career was already well established. Despite challenges related to the demanding combination of working and studying at higher education levels, and the lack of awareness of the opportunity to follow an apprenticeship programme at this level, the paper concludes that computing degree apprenticeships provide good opportunities for school leavers, career changers and upskillers. Degree apprenticeships are clearly paths to innovation that deserve further support.

In Chapter 4, Faun Rice, Valerie Thomas and Julie Lalonde discuss the introduction of an apprenticeship programme for IT occupations, particularly addressed to Indigenous peoples in Canada. Based on consultation with Indigenous-led organisations and Canadian ICT sector representatives, the programme set in place an agile curriculum and adequate support services, which in turn helped achieve success in terms of enrolment, completion rates and transition to employment but also in terms of gender equity. Given the success of the apprenticeship programme in accomplishing its policy objectives, similar models are being developed in other occupational groups, such as a new apprenticeship programme for financial officers.

Not all expansion to new fields refers to high-tech, digital sectors. In several cases, apprenticeship is seen as an education and training option for occupations traditionally accessed through higher education classroom-based settings. The education and healthcare sectors offer such examples.

The paper by Ann Nutter Coffman, Jim Meadows, Kenneth Noble and Stacey Pelika (Chapter 5) discusses the introduction of registered (i.e. formally recognised) apprenticeship programmes for teachers in the United States. Elaborating on a case study of the Washington Education Association apprenticeship residency in teaching (WEA ART) programme (a trade-union-led initiative), the paper shows that the programme, which provides strong workplace experience, has been successful in preparing participants to assume teaching roles, had a positive impact on students' learning and achievement and also helped attract a more racially and ethnically diverse cohort of prospective teachers, more aligned with the demographics of the student population. Early evidence shows that the registered apprenticeship model stands out as a pathway both to expand access to high-quality teacher preparation and to alleviate shortages in the occupation.

In Chapter 6, Erika Molnárné Tóth, Ildikó Horváthné Bócsi and Ágnes Hornyák present an initiative to train early childhood education and care (ECEC) professionals through an innovative dual-learning format that had not previously been applied to early childhood education in Hungary. The programme offers substantial, structured work-based learning in real kindergarten settings (i.e. authentic learning environments) within a certified vocational framework. The paper presents the methodological basis for the introduction of the new programme and a set of benefits, including ensuring a well-rounded preparation of teaching assistants at higher technician levels, with close collaboration between vocational schools and universities; and meeting the growing demand for skilled nursery school teaching assistants.

Romain Pigeaud (Chapter 7) presents examples from the growing use of apprenticeships in the healthcare sector in France. The paper explains that apprenticeship has emerged as a significant recruitment

alternative that has helped alleviate the acute shortages faced in the sector because the majority of apprentices choose to remain with the training employer once they graduate from the apprenticeship programme, among other reasons. The apprenticeship also helped learners develop a fuller set of skills and become integrated in the occupational ethos and culture of their future employers. Moreover, apprenticeships in the healthcare sector give opportunities to people who would not be able to afford the three-year classroom-based alternative. Earning while learning made the choice even more appealing to learners from disadvantaged social backgrounds, highlighting the role of apprenticeships as a 'social elevator'.

The paper by Karin Reiber et al. (Chapter 8) examines the reform of apprenticeship training in the healthcare sector in Germany, which aimed to make occupational and vocational training more attractive to potential nursing candidates by broadening the range of professional activities, thereby enhancing the professional flexibility of nursing professionals. Instead of the previous three separate nursing education paths, tailored to three different age groups, the new vocational nursing degree programme follows a generalist approach that not only represents an expansion in the apprenticeship offer for the sector, but also allows people to gain a professional degree as part of an academic nursing degree programme at EQF level 6. The paper concludes that the success of the reform depends on the strategic increase of workplace-based learning, but also on the existence of sufficient, available, well-prepared teaching and training staff, especially in the workplace (i.e. healthcare units).

The expansion to new fields sometimes involves introducing formal apprenticeship programmes in traditional sectors where formal qualifications were not always an option, such as construction or occupations associated with agriculture. In such cases, the introduction of an apprenticeship programme may enable the development of a wider set of competences, including ones related to sustainability. Such efforts help 'professionalise' a sector, contributing to its ability to attract more new learners and future workers.

In Chapter 9, Linda Clarke, Fernando Durán-Palma and Christopher Winch examine how scaffolding has developed as an occupation and discuss the experiences of introducing a new apprenticeship for scaffolding in Ireland, in relation to long-existing similar programmes in Denmark and Germany and the abolition of such a programme in the Netherlands. The research reveals that introducing a formal apprenticeship programme leading to a (complete) scaffolding qualification has a positive effect on developing a relatively autonomous workforce able to undertake most of the activities involved in the scaffolding cycle, such as project management and waste management. Moreover, the Irish example highlights the role that apprenticeship can play in terms of the status of scaffolders, public recognition of scaffolding as a skilled occupation and opportunities for further career progression, whether to higher education or to supervisory and management positions.

The paper by Miriana Bucalossi, Anna Rita Racioppo, Alessandra Biancolini, Michela Bastianelli and Davide Premutico (Chapter 10) examines the introduction of an apprenticeship programme for winemakers in Tuscany, Italy. Unlike pre-existing, predominantly school-based, options for this sector, the programme introduces a structured dual apprenticeship, where companies assume shared responsibility for the education process. The apprenticeship format proved to be the most popular option for learners, strengthened cooperation between schools and enterprises, improved the alignment between training content and sectoral skill needs, and facilitated earlier and more structured transitions into employment. Moreover, by considering wine districts as a social skills ecosystem, the paper shows that apprenticeship emerges not only as a pedagogical solution, but as a strategic lever for systemic transformation that enables the integration of training provision, employer engagement and policy coordination within the wine sector ecosystem.

Main observations and messages

Apprenticeships can successfully develop the skills required in new sectors

In the perceptions of learners, employers and societies in many countries, apprenticeship has traditionally been, and often remains, largely associated with more manual or technical trades, for occupations requiring a lower or medium level of skills. Conversely, occupations relying on a higher skill level may be associated with traditional higher education settings that are often predominantly classroom based, with shorter periods of learning at the workplace. However, this landscape is changing rapidly. Many sectors turn to apprenticeships to develop a skilled workforce, so they can address acute shortages or due to growing acknowledgement of the importance of workplace learning during studies.

This collection of papers shows that apprenticeships can indeed be an effective, suitable option for qualifying people in these new sectors. The paper by Anna Clara Gatti and Mauro Pelucchi demonstrates that, as highly technical sectors change, they rely more and more on a combination of advanced technical and soft skills, making apprenticeships an increasingly relevant option. In the Fintech, cybersecurity and educational technology sectors, apprenticeship can have a high impact on developing a major part of the skill set required, especially by offering a nuanced understanding of the theoretical knowledge through its practical application and the adaptation of learners to real-world settings. The Canadian paper on the IT apprenticeship programme for Indigenous peoples also demonstrates how apprenticeships can be successfully implemented in rapidly evolving sectors such as IT, which require flexible and responsive training approaches.

Moreover, several papers offer a testimony that apprenticeships can develop a comprehensive set of technical, general and soft skills, alongside integrating learners in the culture of future employers. In France, the new apprenticeship programmes in the healthcare sector have been successful not only in developing the skills required, but also in transmitting the organisational culture and developing the occupational ethos. Similarly, the analysis of scaffolding apprenticeships shows that, where apprenticeship programmes exist to train people for the occupation, they cover a comprehensive set of knowledge, skills and competences that support a well-prepared, autonomous, agile and effective workforce. The winemaking programme demonstrates that apprenticeship-based training enables learners to follow progressively specialised learning trajectories while acquiring both transversal and job-specific skills aligned with territorial needs, incorporating forward-looking topics such as climate adaptation, the green and digital transitions, and sustainability.

Several papers show that employers and apprentices often share the positive view on the suitability of apprenticeship programmes to fully qualify them for their new occupation. The US paper offers substantial evidence that school directors find teachers trained through registered apprenticeships to be just as effective as or more effective than teachers who were qualified through other pathways. At the same time, all WEA ART case study respondents reported that they either agreed or strongly agreed that they were able to engage in an array of professional responsibilities at placement sites. Insurance apprentices in Ireland are positive about how their employability is improved through industry experience, professional qualifications and the honours degree. The opportunity to apply lecture material in practice in real time is viewed as an advantage.

Expansion to new fields can be driven by various actors

The papers included in this publication illustrate the range of actors at the forefront of the introduction of apprenticeships in new sectors or occupations. Reflecting the characteristics of the overall apprenticeship system, new programmes are usually brought forward either by specific sectors (i.e. employer-led initiatives), such as the Irish apprenticeship in insurance, or by the state, as in the case of the government-led introduction of a new apprenticeship programme for early childhood educators.

This collection clearly demonstrates that there is ample room for several other stakeholders to lead the expansion of apprenticeships into new sectors. The US case study shows how, in 2023, a teacher trade

union, the Washington Education Association, launched the first union-run apprenticeship programme in the United States. The programme was designed and is led by practising educators who understand the real challenges and requirements entailed in the teaching profession. The educators have introduced several quality elements that benefit participating apprentices.

The paper in Chapter 10 shows how a regional administration turned to apprenticeships in response to the growing imperative of aligning education and training pathways with labour market demands. Tuscany led the adaptation of the wine technician specialisation programme and has been central to its design, roll-out and evaluation. The programme serves as an illustrative case of how dual apprenticeship can function not only as a training modality but also as a governance tool. It fosters shared responsibility between educational institutions and employers, facilitates the co-design of training content aligned with sectoral needs and contributes to the resilience and adaptability of the regional skills ecosystem.

The paper by Pigeaud explains that, in France, social partners of the skills operator for healthcare (Opérateur de Compétences Santé (OPCO Santé)) created a regional advisory council, a specific governance body dedicated to apprenticeships, representing the sectors covered by OPCO Santé and ensuring that territorial specificities are taken into consideration. The social partners in the sector signed an agreement (in 2020) with the primary goal of supporting employment policies through apprenticeships, by doubling the number of apprentices by 2022. Moreover, the paper offers numerous examples of the greater role played by regions, but also individual schools (through apprenticeship training centres), in increasing the offer of apprenticeships in the healthcare sector.

Indeed, apprenticeship, through systematically bringing the worlds of education and the labour market together, stands in an advantageous position: it offers a tested, structured platform so that programmes in new occupations and sectors emerge as the outcome of social dialogue and multistakeholder collaboration. This is evident in the case of state-led initiatives presented in this publication. In Hungary, the programme is unique in its structured partnership between vocational schools, universities and kindergartens, ensuring well-rounded and research-backed training. In Canada, the IT apprenticeship was launched in 2020 by Employment and Social Development Canada with significant engagement of Indigenous peoples' organisations and in consultation with the IT sector in Canada (private- and public-sector employers), in concert with the Information and Communications Technology Council, a non-profit labour market research and workforce development organisation. This approach allowed the programme to remain agile, adapting training content to the immediate needs of the government of Canada's IT workforce while aligning with the skills valued in the private sector and learning preferences of the apprentice population.

Participating employers can greatly benefit from new apprenticeship programmes in their sectors

On top of documenting the suitability of apprenticeships to provide skills and qualifications in new sectors, this collection of papers offers detailed insights on additional benefits that apprenticeship can bring to employers that engage in apprenticeship training.

The first apparent benefit relates to the contribution of apprenticeships in addressing present skills shortages, representing an alternative pathway to a qualified workforce. For the French healthcare sector, apprenticeship has become an important method of diversifying recruitment, distinct from the traditional practices in the sector, which have historically relied on competitive entrance examinations to enter higher education as a primary recruitment method. Apprenticeship came as a perfect option at a time when, under stress from decreasing workforce trends, healthcare employers were seeking a broader range of training pathways capable of attracting and retaining future graduates. The Irish insurance apprenticeship programme has become important for the talent strategy in almost all interviewed companies. For those employers, apprenticeship supports an industry lacking an established talent pipeline. Respondents felt that the apprenticeship programme offers a defined career pathway that allows the company to plan strategically long term. Moreover, employers note how the apprenticeship reduces onboarding and training costs. In Hungary, the new apprenticeship programme for early childhood educators contrib-

utes to the mitigation of labour shortages in the sector and alleviates the severe consequences of staff shortages in early childhood education. The programme offers comprehensive qualifications to early childhood education and care professionals, which is crucial in the present situation, when more and more kindergarten teachers are retiring.

New apprenticeship programmes are not only about raising workforce numbers. They are also about increasing productivity through the quality of apprentices' contributions during their learning period. Apprentices in the Scottish computing apprenticeship reported that they quickly became useful employees, for example as software testers, and benefited from gaining new skills, even when their career was already well established. The paper identified gains for employers too in terms of the apprentice bringing new skills into their organisation; for example, some of the applied projects became useful elements of the business. In the WEA ART programme, approximately 75 % of site principals either agree or strongly agree that the programme improves education outcomes, as shown in student learning and achievement.

High productivity can be associated with the fact that the apprenticeship model of learning is suitable for embedding the future workforce in the culture of the training organisation. In Ireland, the blended-learning approach applied in insurance apprenticeships encourages learning among all staff, particularly the workplace mentor, who helps apprentices develop their intrinsic company knowledge. In Hungary, apprentices develop skills aligned with the kindergarten's mission of fostering a supportive and enriching environment for children. Therefore, kindergarten leaders can select to hire those apprentices who embody the values of empathy, creativity and dedication to child development to match their kindergarten's culture and values.

Contribution to productivity is often coupled with high loyalty levels: employers' investment in training their future staff is usually followed by high retention rates. The expansion of apprenticeships in the French healthcare sector produced significant benefits in terms of workforce retention: recruiting apprentices trained in nursing schools within the sector has proven to be effective, with the majority of apprentices choosing to remain with the employer after the apprenticeship contract ends. In Ireland, two thirds of interviewed employers in the insurance sector agree that apprenticeships are the right instrument to retain talent, and apprentices demonstrate greater loyalty in terms of retention.

Another benefit for employers that emerges from the papers relates to improving the attractiveness of the sector. Numerous papers in this collection show that placing apprenticeships in new sectors and occupations helps attract young learners who would not normally consider apprenticeships an educational pathway to enter these fields. The papers on the introduction of apprenticeship programmes for winemaking and scaffolding reveal that the apprenticeship programmes contribute to the image and the professionalisation of the sectors, improve learning and working conditions and support progression opportunities, therefore making these sectors more attractive to learners.

Learners enjoy considerable benefits by joining apprenticeship programmes in new fields

Earning while learning is a key advantage for learners participating in apprenticeships, different from most other education and training options. Papers in this publication repeatedly demonstrate that this competitive advantage becomes even more critical when apprenticeships are opened up to new occupations that were typically accessed through traditional higher education programmes. Most notably, in the US context, where higher education student loans are a major economic and social concern, teaching apprenticeship programmes (such as WEA ART, studied here) remove financial and other barriers for apprentices. WEA ART apprentices are paid an annual salary of at least USD 40 000, which progresses based on the district's paraeducator wage structure. Apprentices also receive social welfare benefits and are covered by a collective bargaining agreement. In France, apprentices enrolled in certified care assistant programmes often come from disadvantaged social backgrounds and work during their studies. Signing an apprenticeship contract, with the remuneration it implies, is a major factor in attractiveness, meeting the financial needs of apprentices and promoting rapid professional integration. In Ireland, degree apprenticeship represents a cost-effective higher education pathway for learners and a stepping stone in their career and future learning. The ability to earn is an important component of the

model, as is the valuable workplace learning.

Several papers also show that, by offering full formal qualifications (often at higher education levels), apprenticeships in new, non-traditional sectors may be associated with significant financial gains for apprentices after they graduate from their apprenticeship programmes. The case of Irish insurance apprenticeships represents a notable success story for graduate earnings: programme graduates enjoy high earnings from the year of their graduation, similar to or higher than the earnings of those who have completed other education and training options at the same (higher education) level. In fact, their average earnings reach the national average wage (i.e. income across all occupations, levels and ages) only three years after graduation, highlighting the ability of apprenticeships to lead to well-paid jobs. Moreover, introducing apprenticeship programmes in occupations typically relying on less comprehensive or informal education and training options, such as in winemaking and scaffolding, clearly opens new opportunities for learners to advance either through higher education or in the organisation hierarchy, in both cases improving their opportunities to progressively enjoy higher earnings.

Apprenticeships in these new fields also provide learners with pedagogical support and a supporting framework that is not always present in other training offers typically offered in these fields. Most papers in this publication illustrate the support provided by teachers and in-company trainers that is inherent in apprenticeship programmes as a key success factor and motivator for learners. In the US teaching apprenticeship programme (WEA ART), over 90 % of respondents either agreed or strongly agreed that the school community had a positive influence on their learning and growth as a teacher and provided sufficient opportunities to collaborate with others. In Hungary, the structured supervision embedded in the apprenticeship learning model ensures that apprentices acquire the necessary creative, digital and technical competences, allowing kindergartens to nurture their ideal candidates. In the Canadian case, IT apprentices have access to several mentors, including supervisors, who provide typical managerial oversight; peer partners, who work on day-to-day tasks with the apprentice within their hiring department; and success facilitators, who are designated mentors within the programme staff who make sure the programme is delivered in a standardised manner, offering support to both apprentices and host organisations.

The expansion of apprenticeships in new sectors is a catalyst for inclusiveness

Coupling a wage during learning with the existence of various supporting roles embedded in the apprenticeship model, new apprenticeship programmes offer significant motivation to individuals from learner groups that are not strongly represented in other education options in these fields. The reinforced participation of less privileged groups in education and training through apprenticeships becomes even more prominent when the new apprenticeship programmes are introduced at higher education levels. The French healthcare sector experience clearly demonstrates that apprenticeship facilitates entry into training for people who are unable to pursue the traditional (higher) education offers, due to personal or financial limitations. Higher education apprentices tend to come from less privileged social backgrounds than students in traditional academic pathways. The remuneration provided through apprenticeship enables more population groups to participate in education and training. This is particularly evident among those over 26 years of age. Apprenticeship thus emerges as a vehicle for social elevation and social diversification in workforce recruitment. The US teacher apprenticeship programme has been successful in attracting participants who are racially and ethnically closer to the demographics of the student population, and more diverse than the current teacher workforce. Similarly, in Scotland, many of the upskillers in the computing degree apprenticeships were from less advantaged backgrounds and benefited from a ‘belated opportunity for degree-level study’.

High-quality learning and access to full qualifications are success factors for establishing apprenticeships in the new sectors

Cedefop and the OECD understand apprenticeships as programmes that, inter alia, lead to formally

recognised qualifications. However, the rapid emergence of apprenticeships in a new sector may not always be followed by a comprehensive set of quality criteria such as the ones described in the Council recommendation on a European framework for quality and effective apprenticeships and International Labour Organization Recommendation 208.

Several papers in this publication highlight the importance of equipping the new programmes with a comprehensive set of quality elements that fit the true characteristics of an apprenticeship, as these maximise the potential benefit for participating employers and learners, and can support the effectiveness of these programmes in the new sectors in the longer term. The analysis of training options in scaffolding shows that, when training results only in (partial) certification, it is linked with a degree of fragmentation of the work process and multiple levels of hierarchy within the overall occupation. In contrast, extensive and comprehensive apprenticeship programmes leading to a scaffolding qualification imply a relatively autonomous workforce, able to undertake most of the activities involved in the scaffolding cycle. Apprenticeship contributes to the public recognition of scaffolding as a skilled occupation and offers permeability for further career progression, whether to higher education or to supervisory and management positions. The absence of requirements for formal education (such as through apprenticeship programmes) in the sector may lead to a two-tier labour market, where part of the workforce receives minimal training, usually limited to health and safety, and therefore cannot benefit from career progression or flexible adaptation to changing industry needs. Analysis of the wine technician programme in Tuscany also shows that the apprenticeship format can serve as a gateway to higher-level roles and educational progression. However, the absence of formal linkages between vocational and university-level qualifications currently limits vertical permeability within the sector. Bridging the gap between academic instruction and workplace learning makes the system more attractive to students and more responsive to the wine industry's demand for highly skilled professionals. In Hungary, the high quality of the apprenticeship programme is guaranteed by the fact that it is a certified technician programme, offering students a clear progression path to higher education and specialised knowledge in early childhood education. It is also based on structured quality assurance processes: the apprenticeship is monitored and quality-controlled by educational authorities and stakeholders, ensuring it meets evolving educational and workforce needs.

Ensuring teaching and training capacity is a key success factor when introducing apprenticeships in new fields

Apprenticeship as an education and training option largely relies on the contributions of, and frequent collaboration among, teachers in education and training institutions (vocational education and training schools, higher education institutions) and in-company trainers who have training and mentoring roles in the workplace.

This collection makes the case for intensifying timely investments that secure teaching and training staff in the new apprenticeship programmes who are sufficient (in terms of numbers and knowledge/expertise), well prepared, qualified, motivated and familiarised with apprenticeships as a distinct education process. However, several papers in this contribution reveal that introducing apprenticeships in new sectors and fields, especially when it comes as an agile response to pressing skills shortages, is not always underpinned by the presence of such sufficient, well-trained or available teaching and training staff – something that is even more evident in the workplace component, as in-company trainers in these new fields are often unfamiliar with the requirements and practices tied to apprenticeship training. In the case of the German nursing apprenticeships, one of the most critical challenges is ensuring sufficient training capacity, particularly in terms of qualified practical instructors in the workplace. Only about 1 in 5 students receives the legally required amount of practical instruction, primarily due to shortages of trained practical instructors who must often perform regular nursing tasks instead of providing structured training. This highlights the essential need for countries to plan and invest in training instructor capacity before expanding programmes, ensuring adequate availability of qualified workplace trainers who can

dedicate proper time to educational responsibilities. In the case of Scottish computing apprenticeships, although the role of workplace mentors in the programme's success has been widely acknowledged, the study revealed a lack of training provided to workplace mentors, with few mentors aware of available training and most training provided only during induction. In the winemaking sector in Italy, the success of the new programme relies on the ability of teaching staff – both in schools and in enterprises – to link theoretical content with evolving production practices. However, many educators face challenges in aligning their teaching with sectoral innovations due to limited exposure to modern viticulture techniques and insufficient training in dual-learning methodologies. Targeted initiatives – such as joint training for school-based and company tutors, structured collaboration with wineries and learning experiences in production environments – have proven effective in building this capacity.

Expansion to new sectors requires additional efforts to raise awareness and address persisting perception issues

In several EU Member States and OECD member countries, many labour market actors and considerable parts of the world of education and society still perceive apprenticeships as programmes offered mostly for crafts or low- to medium-level technical occupations, typically at secondary education levels, often for learners who had difficulties performing in general education settings. This collection offers examples of such misperceptions in relation to the prestige, the position and the quality attached to apprenticeship programmes and the opportunities offered to its graduates, which remain in many countries. This can be more prominent when apprenticeships are not traditionally offered in a sector: more effort may be required to convince employers in such a sector that apprenticeship is a suitable training offer for them. At the same time, similar effort may be needed to turn the attention of learners (and in the case of young people, their families) to apprenticeship programmes that have only recently emerged in new fields. Systematic, intensified awareness raising among employers and learners is often necessary for successfully rooting programmes in new sectors. In Scotland, a lack of awareness of the degree apprenticeship opportunity is noted: the combination of apprenticeship and degree is not well known and some apprentices have status worries about how their qualification will be regarded. In Italy, in the initial roll-out of the new wine technician apprenticeship programme, company participation was limited, largely due to the perception among companies that the apprenticeship model implied increased responsibilities for companies compared with traditional internships. Subsequent evaluation of participating companies revealed that this was not the case.

Additional communication efforts may be needed when the low overall sector attractiveness may pose limitations for the successful introduction of apprenticeship programmes. In France, the healthcare sector suffers from low attractiveness, and companies struggle to retain their employees, due to relatively low salaries, demanding work conditions and the poor image associated with certain professions, such as that of nursing assistants.

This collection clearly demonstrates that the expansion of apprenticeships in new fields is associated with significant benefits for employers and learners, but also sectors, local communities and societies. However, these benefits are not always made evident outside the (small) circle of actors involved in apprenticeships in these new fields. Rigorous monitoring and evaluation can help reaffirm the value of apprenticeship programmes and contribute to awareness raising, by producing clear evidence on the benefits realised by participating in apprenticeships.

CHAPTER 1.

Expanding horizons: mapping the frontier of apprenticeships in emerging sectors using big data

By Anna Clara Gatti and Mauro Pelucchi ([1])

1.1. Introduction

In an era marked by technological transformation and rapid sectoral shifts, apprenticeships are emerging as an essential component in addressing both the immediate talent shortages (Brown et al., 2024) and the long-term needs of evolving industries (European Commission Directorate-General for Employment, Social Affairs and Inclusion, 2024). Traditionally focused on sectors such as manufacturing and skilled trades, apprenticeships have long provided a structured approach to vocational training. However, the rapidly changing economic landscape, combined with persistent skills gaps across Europe, necessitates a broader approach. The expansion of apprenticeship models into non-traditional sectors such as cybersecurity, financial technology (Fintech) and data science (Cambridge Spark, n.d.) is not just timely but crucial for addressing current labour market demands.

Recent data from Eurostat, the statistical office of the European Union, indicate that talent shortages continue to challenge industries. Finding workers with the right skills has become a critical challenge across European businesses of all sizes. Among medium-sized companies (50–249 employees), 68 % report skills shortages as a serious issue, closely followed by small companies (10–49 employees), at 65 %. For microcompanies (fewer than 10 employees), 53 % face similar challenges (European Commission, 2024a).

The problem has persisted over time. Looking at hiring experiences in 2023-2024, 80 % of medium-sized companies struggled to recruit qualified staff. Microcompanies faced similar difficulties, with 61 % reporting challenges in finding employees with the necessary skills. These shortages are particularly acute in high-tech and green sectors, where the need for digital and advanced technical skills is growing exponentially (ILO, 2022). For instance, nearly 42 % of the EU workforce lacks the basic digital skills required in the modern economy, highlighting a pressing need for upskilling and reskilling initiatives.

The global landscape of apprenticeship programmes is currently facing a critical talent shortage, a phenomenon that is drawing considerable attention from both academic and industry circles. This shortage is not merely a localised issue but a pervasive challenge that spans various sectors and geographical regions. In an era characterised by rapid technological advancements and evolving industry demands, the traditional apprenticeship models are being scrutinised for their capacity to meet contemporary workforce needs. The significance of this issue is underscored by its potential impact on economic growth, skills development and competitive advantage on a global scale.

Scholarly discourse indicates a mismatch between the skills required by employers and those possessed by prospective apprentices (Cedefop, 2018). Evidence (Cedefop, 2018) underscores the scale of this challenge, revealing that, as early as 2013, 4 in 10 EU employers reported difficulties in finding recruits with the right skills. This skills gap is exacerbated by the increasing complexity of job roles, particularly in high-tech and specialised fields, where the demand for skilled labour far exceeds the

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supply. As industries continue to innovate, the pressure mounts on educational institutions and training providers to adapt their curricula to include emerging skills, such as those related to digital literacy and advanced technical competences.

Furthermore, demographic shifts, including an ageing workforce and declining birth rates in several developed nations, contribute to the scarcity of young talent entering apprenticeship schemes. This demographic trend necessitates a re-evaluation of recruitment strategies and an increased focus on inclusivity and diversity to attract a broader range of candidates into apprenticeship pathways. Such measures may include enhanced incentives for apprentices, investments in modern training facilities and the integration of digital platforms to facilitate remote learning and skills acquisition.

The *Future of European Competitiveness* (European Commission 2024b) further underscores the importance of apprenticeships in enhancing productivity and driving economic growth in Europe. The report highlights that firms that invest in vocational training, particularly through apprenticeships, experience significant gains in innovation and competitiveness.

This study contributes to this discourse by investigating the expansion of apprenticeship models into high-growth, non-traditional sectors such as cybersecurity, educational technology and Fintech. By analysing data from national labour force surveys and country reports (Italy and the United Kingdom), we aim to identify and examine sectors where apprenticeship programmes are gaining traction. Addressing these new sectors reflects the evolving landscape of vocational education and training (VET), where traditional, classroom-based learning is often insufficient to meet the rapidly changing demands.

A key component of our research is the integration of big data analytics. We leveraged online job postings to extract insights into skill requirements, sector evolution and emerging job titles. Using natural-language-processing techniques, we mapped these job postings against the Lightcast open skills taxonomy. This data-driven approach enables us to identify skills gaps and potential curriculum alignments, ensuring that apprenticeship models are responsive to the needs of rapidly evolving sectors.

Furthermore, the study quantifies the application of apprenticeships in these emerging sectors, analyses the drivers behind this expansion and assesses the challenges and opportunities unique to implementing apprenticeships in these fields. By combining formal education with immersive real-world experience, apprenticeships offer a distinct edge over traditional vocational education pathways, particularly in sectors where practical, up-to-date skills are essential. Using generative artificial intelligence (AI), we measured the success factor of each skill to propose a tailored skills framework for each new emerging field.

By expanding apprenticeships into new sectors, Europe has the opportunity to address its critical skills shortages, promote innovation and enhance workforce development. As highlighted in recent studies (e.g. Goller et al., 2023), the advent of AI and other advanced technologies is reshaping occupational choices and skills demands. Apprenticeships must adapt to this changing landscape to remain an effective tool for workforce development, ensuring that individuals are equipped with the skills needed to succeed in the jobs of the future (Katz & Krueger, 2019). This study explores the adaptability of the apprenticeship model to these new domains, providing a comprehensive analysis of the potential impact on skills development and labour market outcomes. Through our novel approach of integrating big data with established educational frameworks, we aim to offer actionable insights for policymakers, educators and employers on how to shape the future of apprenticeships in Europe.

1.2. Methodology

1.2.1. **Job postings data**

This study draws on data from Lightcast's extensive job postings database. Each day, Lightcast collects and processes billions of job advertisements from diverse sources including job boards, newspapers

and company websites. The data undergo rigorous cleaning and deduplication to ensure that each job opening is counted only once, regardless of where it appears.

Using both official and proprietary classification systems, Lightcast analyses each posting to extract key details such as location, industry, occupation and required skills. Unlike traditional employment statistics, this approach provides near real-time insights into employer demands, helping identify emerging trends before they surface in official data. The granular nature of the information also enables deeper understanding of labour market dynamics.

However, data have limitations (Vermeulen & Gutierrez Amaros, 2024). Their accuracy depends on employers' use of online job listings, which varies by sector. Professional roles such as in software development are well represented, while lower-skilled positions such as those in food service or agricultural work are often under-represented, as these jobs are frequently filled through other channels.

1.2.2. Lightcast open skills taxonomy

The Lightcast open skills taxonomy is a comprehensive framework that catalogues over 32 000 skills, developed through more than a decade of labour market analysis. Unlike traditional, survey-based taxonomies, it employs a dynamic, big data approach by continuously collecting and analysing job postings and social profiles, enabling real-time updates as skills evolve and emerge. The taxonomy employs three methods to add new skills:

(a) algorithmic detection using machine learning to identify potential skills from job postings;
(b) qualitative research by labour market experts who investigate volatile market areas;
(c) direct input from industry-leading partner companies.

Skills are then classified into three distinct types: common skills (baseline abilities such as communication and problem-solving), specialised skills (technical capabilities specific to occupations, including software skills) and certifications (industry-recognised qualifications). To enhance navigation and understanding, skills are organised in a three-layer hierarchy consisting of broad categories (aligned with career areas), subcategories (i.e. specific job aspects) and individual skills (Table 1). The taxonomy's effectiveness stems from its four key characteristics: granularity (detailed enough for specific analysis while remaining accessible in aggregate), specificity (accounting for both general and distinct skills), global applicability (usable across different regions and industries) and responsiveness (regularly updated to capture emerging skills).

Table 1. **Examples of the Lightcast open skills taxonomy by category**

Category	Subcategory	Type	Skills
IT	Software development tools	Specialised	Docker compose Angular framework
	AI and machine learning	Specialised	Machine-learning methods Kernel methods Autoencoders Seq2seq
Finance	Financial analysis	Specialised	Expense analysis Stock valuation Expense forecasting
	Financial advisement	Common	Financial literacy
Education and training	Special education	Specialised	Teaching exceptional children Teaching people with learning disabilities

1.2.3. **Selecting new fields of apprenticeship application**

For the identification of new fields where apprenticeships could be applied, the analysis draws on three primary datasets to assess trends in vocational education and employment across Europe, Italy and the United Kingdom.

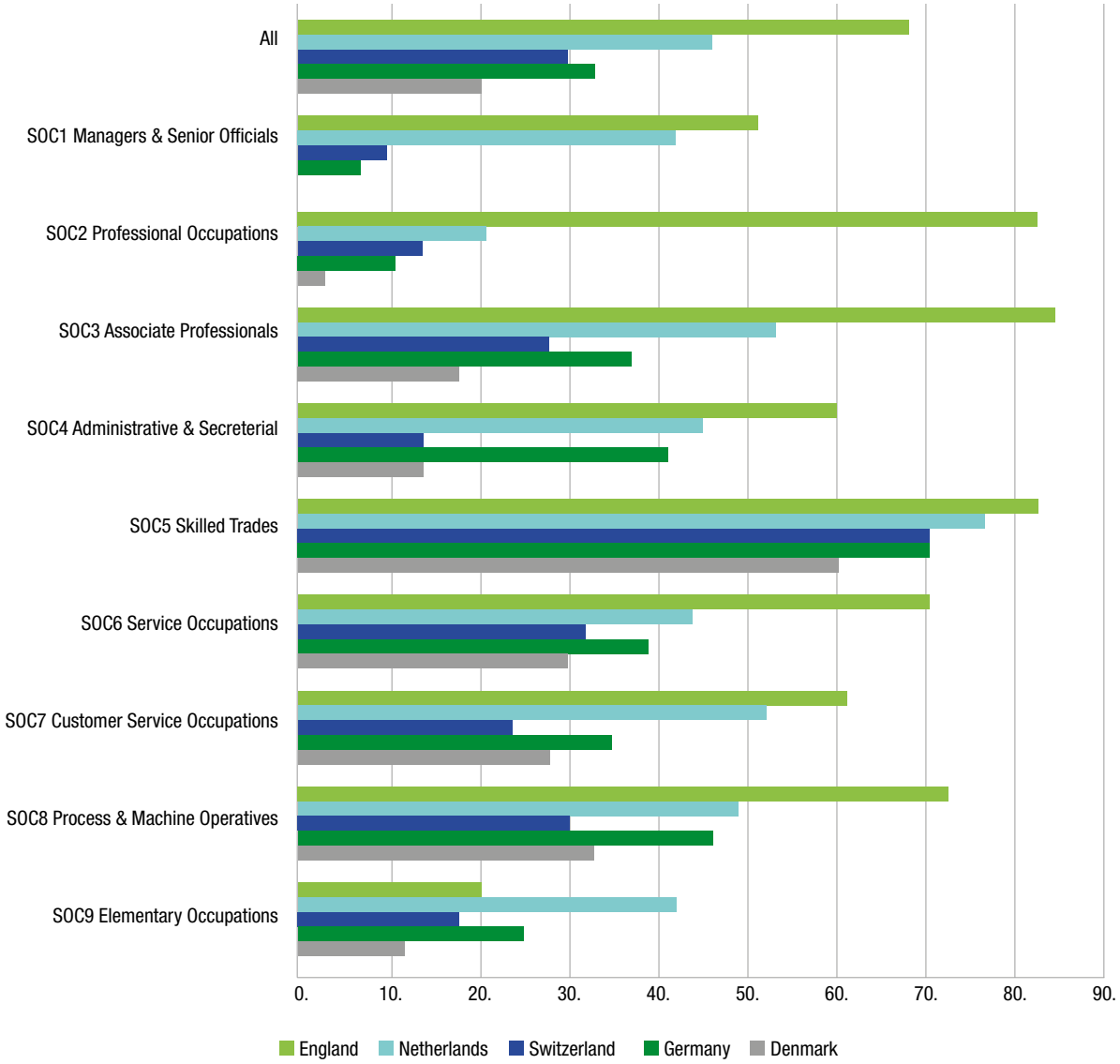
(a) Eurostat dataset on educational attainment level and the transition from education to work **(based on the EU Labour Force Survey (EU-LFS))**. The EU-LFS provides essential insights into how vocational education is supporting labour market transitions across the EU. This dataset was used to identify which sectors currently rely on apprenticeships and highlights gaps where apprenticeships could be expanded to meet emerging labour market demands, particularly in fields requiring digital and green skills.

(b) **XXI Monitoring Report of the VET System and Dual Pathways (2021–2022) (INAPP, 2023)**. That report offers detailed insights into how apprenticeships are applied within Italy's dual-learning system. It identifies sectors with strong apprenticeship uptake, such as engineering and health services, while also signalling potential for growth in areas such as renewable energy and digital services.

(c) UK apprenticeship statistics. The United Kingdom's official statistics on apprenticeship enrolments provide an in-depth look at how apprenticeships are distributed across various sectors.

Norman (2022) compares the occupational coverage of apprenticeship systems in Denmark, England, Germany, the Netherlands and Switzerland using a harmonised methodology based on Standard Occupational Classification (SOC) 2010 codes. Apprenticeship standards in each country were mapped to four-digit SOC codes, using automated tools alongside manual validation to ensure accuracy. The analysis focuses on the number and type of occupations covered, highlighting key differences in system design and intent. The findings show that England's apprenticeship system stands out for its broad occupational coverage, spanning 68 % of SOC occupations, including managerial and professional roles that are typically excluded in continental systems. In contrast, countries such as Germany and Switzerland concentrate apprenticeships in skilled trades and technical occupations, with narrower coverage but often deeper specialisation. Participation rates also vary, with Switzerland having the highest relative uptake and England a more diverse age profile, reflecting the national apprenticeship system's dual aim of enabling youth entry and adult reskilling (Figure 1).

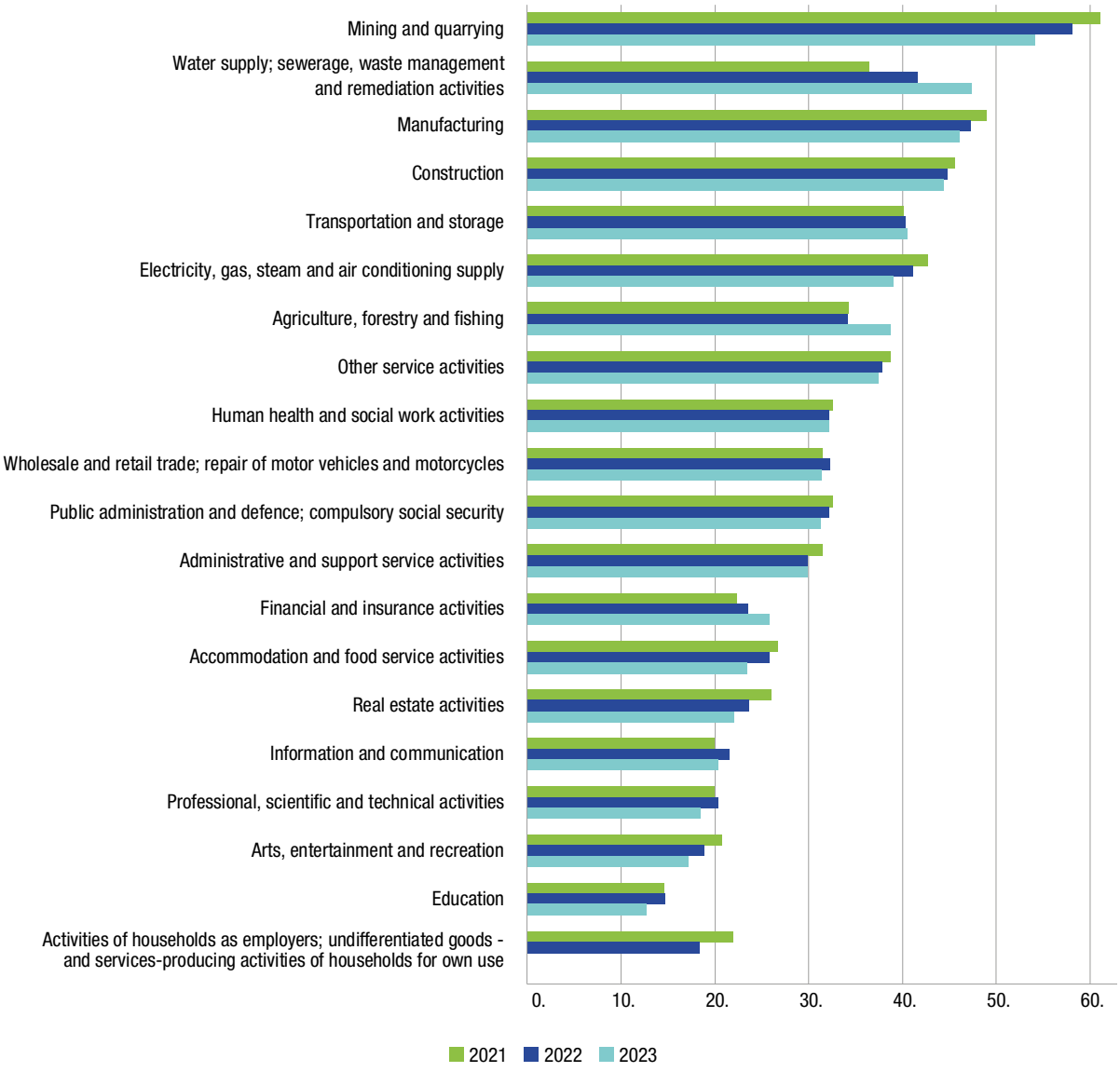
Figure 1. **Percentage of four-digit SOC code occupations covered by apprenticeships for each major SOC group in Denmark, England, Germany, the Netherlands and Switzerland**



Source: Norman, 2022. Adapted by the authors.

EU-LFS data show that apprenticeships in Europe remain concentrated in traditional sectors such as construction, manufacturing and healthcare (Figure 2). However, sectors linked to the digital economy, including information technology (IT) services and green technologies, are increasingly in need of skilled labour. The data suggest that there is a significant opportunity for expanding apprenticeships into these fields, which require both technical skills and hands-on experience. For this analysis, we focused on individuals with upper secondary and post-secondary non-tertiary education levels (International Standard Classification of Education levels 3 and 4).

Figure 2. **Share of employees by educational attainment level and NACE Revision 2 activity – upper secondary and post-secondary non-tertiary vocational education (ISCED levels 3 and 4)**



NB: ISCED, International Standard Classification of Education; NACE, general industrial classification of economic activities within the European Union.

Source: Eurostat dataset on educational attainment level and the transition from education to work (based on the EU-LFS). Adapted by the authors.

This trend is confirmed by the Italian monitoring report (Table 2). The data highlight that the dominant vocational fields in Italy remain traditional sectors such as wellness, hospitality/tourism and manufacturing. These sectors continue to attract a significant number of students, reflecting stable demand in the Italian job market for skilled workers in these areas. However, enrolment drops significantly when transitioning to advanced technical qualifications, indicating a potential gap in specialised skills development. Looking forward, there is a strong case for expanding vocational training into emerging fields such as Fintech, cybersecurity and educational technology, which are experiencing rapid growth. The increasing digitalisation of industries calls for a shift in vocational education, preparing students for roles that require advanced technical skills in sectors with high growth potential.

Table 2. **Distribution of enrolments in Italy by numbers of professionals and year – 2021–2022 (top 10 occupations)**

Years 1–3	
Wellness operator	33 618
Catering operator	25 280
Motor vehicle repair operator	10 527
Electrical operator	10 450
Mechanical operator	9 907
Food production operator	6 184
Graphics operator	5 751
Promotional and reception services operator	4 153
Business services operator	3 495
Agricultural operator	2 629

Years 4	
Beauty treatment technician	1 982
Hairdressing technician	1 955
Kitchen technician	1 757
Motor vehicle repair technician	1 449
Graphic technician	1 121
Food production technician	1 004
Bar and restaurant services technician	898
Production plant planning and management technician	795
Industrial automation technician	754
Electrical technician	727

NB: Table 2 presents data derived from Italy's education and vocational training (Istruzione e Formazione Professionale (IeFP)) system, focusing on enrolment and qualification trends across vocational pathways. IeFP refers to the regional VET system in Italy, aimed at young people who have completed lower secondary education. It focuses on delivering practical skills and occupational knowledge to prepare students for entry into the labour market or further studies. The data include figures related to the type 1 apprenticeship (Apprendistato di primo livello), which is formally integrated into the IeFP framework as a dual pathway that combines classroom-based vocational education with work-based training in companies.

Source: INAPP, 2023.

Data from the UK Office for National Statistics (UK apprenticeship statistics) shows a broad distribution of apprenticeship enrolments across a wide range of sectors in the United Kingdom, with concentrations in traditional and foundational fields. Despite strong enrolments in traditional fields, sectors such as information and communications technology (and accounting and finance signal a growing interest in more technically advanced professions. However, key emerging fields such as Fintech and cybersecurity are not distinctly represented in the current dataset, raising the question of whether these programmes are simply under-reported or genuinely suffer from very low enrolment. This lack of visibility suggests a need for targeted expansion in high-demand digital areas to meet the requirements of an increasingly digitised economy. For example, information and communications technology accounts for only 0.03 % of total apprenticeship enrolments, revealing a gap that could be addressed by developing dedicated apprenticeship pathways for roles in IT infrastructure, software development and cyberse-

curity. This is particularly relevant given industry calls for scalable tech talent pipelines; as CompTIA (2025) notes, while 'employers are struggling to find qualified candidates to fill high-demand roles… apprenticeships and alternative training paths have emerged as viable solutions. These programs offer a practical, hands-on approach to learning, equipping individuals with the skills they need to succeed in tech careers.' Similarly, emerging sectors such as media and communication (0.19% of total enrolments) and environmental conservation (0.08% of total enrolments) show relatively low enrolment, pointing to untapped opportunities for growth, especially in the context of increasing environmental concerns and the digitalisation of creative industries.

1.2.4. Applying generative AI to assess apprenticeship success ratios for skills development

In the context of this study, we define the success ratio as the measure of how effectively an apprenticeship programme provides students with the opportunity to acquire relevant skills, compared with other educational pathways. Specifically, the success ratio captures the likelihood that students can attain the required competences through work-based learning. This is particularly important in fields where hands-on experience is relevant, and the theoretical knowledge acquired in traditional education may not be sufficient.

The underlying hypothesis of this approach is that apprenticeships tend to be more successful in fields where the required skills are less 'remote', meaning they can be acquired through practical application rather than abstract learning. While 'remotability' and the apprenticeship success ratio are distinct concepts, they can be complementary. Remotability refers to where a skill can be used (i.e. whether it is suitable for remote work or requires physical presence), whereas the success ratio reflects how effective apprenticeships are in delivering that skill, relative to other forms of education.

High-impact apprenticeships (Cedefop & OECD, 2021) refer to apprenticeship programmes that are particularly effective in equipping learners with job-relevant skills, leading to strong labour market outcomes such as high employability, wage growth and career progression. They are typically characterised by:

(a) close alignment with labour market needs, ensuring that training reflects current and emerging industry demands;
(b) strong employer involvement, where companies co-design or co-deliver the training content;
(c) work-based learning as a core component, allowing apprentices to acquire complex, occupation-specific skills through hands-on experience;
(d) structured progression pathways, offering access to further qualifications or career advancement;
(e) a focus on fields where practical application of skills is essential, making the apprenticeship model particularly effective compared with classroom-based education.

To assess the effectiveness of apprenticeships in delivering relevant skills, we adopted a multistep approach based on generative AI, integrating vector embeddings, a retrieval-augmented generation (RAG) system and a comparative analysis across multiple language models.

(a) **Creating vector embeddings**. We began by creating vector embeddings to represent the key components required for the analysis. The vector embeddings were constructed using (a) the skill label, (b) its description and (c) the top 10 occupations in demand using data from Lightcast's global database.
(b) **Using a RAG approach to measure remotability and calculate the success ratio.** We implemented a RAG approach, where the same question was posed to multiple generative AI models to assess their agreement and insights. The models were tasked with answering two core questions.
    (i) **Remotability of skills**. Can this skill be effectively used in remote work settings or does its performance require physical presence? In this context, remotability refers to the degree to which a skill is compatible with remote or telework arrangements. For example, digital communication or coding skills may be highly 'remote' while machine operation or caregiving typically require physical presence.
    (ii) **Success ratio of apprenticeships**. How likely is it that this skill can be effectively acquired

through an apprenticeship compared with other forms of education (e.g. academic or theoretical instruction)? The success ratio reflects the relative suitability of apprenticeship training for a given skill, capturing the effectiveness of learning that skill in a work-based, practical setting.

(c) **Producing results**. Once the AI models responded to the posed questions, we retrieved their results for further analysis. Each model provided its own assessment of the remotability and success ratio for each skill, based on its training and understanding of the context provided by the vector embeddings. To evaluate the consistency and reliability of the AI models' responses, we introduced a metric to measure the level of agreement across the models. This agreement metric (an intraclass correlation coefficient) assesses the variance in responses to the same questions and is essential for determining the robustness of our findings. In Table 3, we provide an example of the results.

In our framework, we use a high success ratio and low remotability as a proxy for identifying high-impact apprenticeships – that is, apprenticeships that are particularly effective in enabling learners to acquire in-demand skills through work-based learning. A high success ratio suggests strong alignment between the apprenticeship model, the nature of the skill and labour market needs. Low remotability often aligns with higher apprenticeship effectiveness, since hands-on skills are typically learned better on the job, although this is not always the case. Remotability helps contextualise the learning environment.

Table 3. **Remotability and apprenticeship success ratio – examples from the Lightcast open skills taxonomy**

Skill	Remotability score	Apprenticeship success ratio score	Agreement metric (remotability score)	Agreement metric (success ratio score)
Plumbing	0.20	1.00	0.95	0.91
Python (programming language)	0.80	0.90	0.88	0.84
Financial forecasting	0.70	0.60	0.69	0.72
Special education	0.30	0.70	0.79	0.86
Community education	0.60	0.80	0.73	0.68
Cyberengineering	0.70	0.80	0.77	0.75
Cyber laws	0.70	0.40	0.51	0.58
Cybersecurity policies	0.70	0.60	0.70	0.81
Mechanical tools	0.20	0.90	0.89	0.93
Thermomechanical analysis	0.30	0.60	0.71	0.79
npm (Node Package Manager)	0.85	0.78	0.90	0.89
SQL Server Express	0.8	0.98	0.9	0.76
Lean warehousing	0.75	0.65	0.85	0.56

NB: SQL, structured query language.

Source: The authors, using Lightcast global postings.

The relationship between remotability and the apprenticeship success ratio provides valuable insights, but it is not always linear. While low remotability combined with a high success ratio aligns well with expectations (i.e. practical, hands-on skills are best acquired through apprenticeships), the results reveal more nuanced patterns.

(a) **Low remotability and high success ratio (e.g. plumbing)**. This is the ideal apprenticeship scenario. The skill must be performed in person and is most effectively learned through direct workplace experience.

(b) **High remotability and high success ratio (e.g. Python)**. This might seem counterintuitive at first: why would a skill that can be practised remotely benefit from an apprenticeship? This reflects cases where mentorship, real-world application and iterative feedback are still important. In tech roles, even if remote work is feasible, structured work-based learning adds significant value for junior learners navigating complex tasks.
(c) **High remotability and moderate success ratio (e.g. cyberlaw)**. These skills may be easily performed remotely but require theoretical depth (e.g. legal frameworks, regulatory compliance).
(d) Moderate remotability and high success ratio (e.g. community education). These are 'hybrid' roles, where both interpersonal interaction and flexibility are needed. Apprenticeships work well here because they combine practical exposure to real communities with reflective learning, even if parts of the role can be performed remotely.
(e) **Low remotability and moderate success ratio (e.g. special education)**. Some hands-on roles, especially in complex human-centred domains, may not fully benefit from standard apprenticeship structures due to emotional, ethical or pedagogical considerations, which necessitate more than just experiential learning.

1.3. Findings and discussion

Using the methodology set out above, this section first examines the application of generative AI to measure the success ratios of apprenticeships across various sectors. The analysis focuses on the effectiveness of apprenticeships in equipping students with key skills by assessing the 'remotability' of those skills – that is, how effectively they can be taught through hands-on learning as opposed to theoretical instruction.

The findings are then discussed in the context of emerging sectors such as cybersecurity, Fintech and educational technology, where apprenticeships have the potential to fill critical skills gaps. For each emerging sector, to ensure relevance and comparability, we present some trends and insights. The selection of countries varies slightly across sectors, reflecting differences in data availability, national apprenticeship structures and sectoral specialisation. The country selection is based on observed trends in the data, evidence from best practices, and policy developments.

To guide the analysis of apprenticeship relevance across sectors, we constructed a framework skill set, a curated list of key skills that reflect the most in-demand capabilities in the specific domains. A framework skill set is defined as a combination of technical, regulatory and transversal skills that are consistently required across occupations within a sector and are suitable for alignment with training or apprenticeship pathways. The skills were identified through co-occurrence analysis of job postings, using Lightcast's global database. We selected the most frequently recurring skills that co-appeared with sector-specific skills (e.g. 'financial technology', 'cybersecurity', 'special education') in job descriptions, to ensure that the list captures context-relevant, in-demand competences. To select skills, we applied thresholds derived from AI model scoring, where:
(a) skills were marked as 'remotable' if they received an average remotability score above 0.6 across the AI models;
(b) skills were labelled as 'high-impact for apprenticeships' if their apprenticeship success ratio exceeded 0.7.

Skills that do not fall into either category – that is, they are neither highly remotable nor strongly aligned with apprenticeship delivery – are still important but may require alternative or hybrid training models. For example, a skill may be too context-specific or cognitively complex for apprenticeship models or require blended-learning approaches that combine theoretical education with limited, targeted work-based learning. These thresholds were derived from AI model outputs using a RAG pipeline and

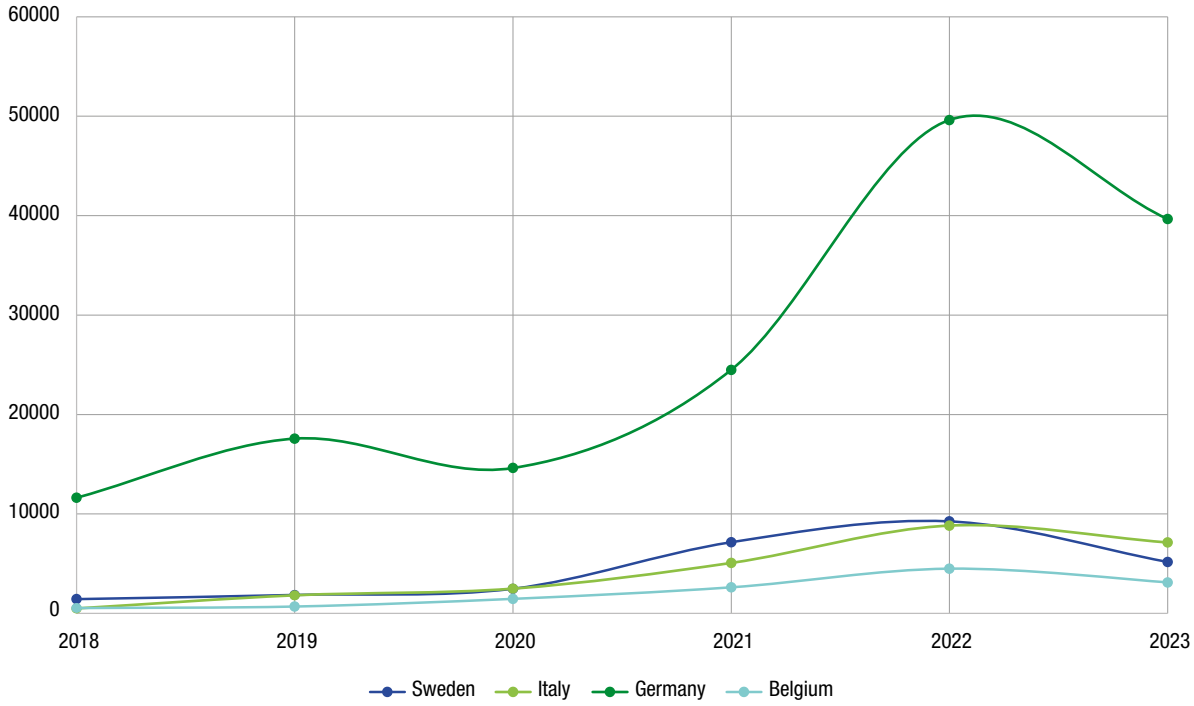
validated through inter-model consistency metrics (see Section 1.2.4). Skills that did not meet either cut-off remain part of the broader skill set but may require more specialised, hybrid, or institutional training approaches rather than apprenticeship alone.

1.3.1. Financial technology

The analysis of the Fintech sector in Europe highlights significant growth in demand for key occupations related to Fintech from 2018 to 2023 (Figure 3), with notable growth in countries such as Belgium, Germany, Italy and Sweden. These countries are strategically important for Fintech for several reasons. Germany – Europe's largest economy – stands out with a rapidly expanding Fintech ecosystem (McKinsey & Company, 2022), particularly in hubs such as Berlin and Frankfurt, which fuels strong demand for digital finance talent. Sweden is a leader in digital innovation and cashless payments, making it a natural incubator for Fintech startups and forward-looking education models. Italy has experienced significant digital transformation in its banking and insurance sectors, creating new opportunities for youth employment through reskilling and apprenticeship pathways (Italian Ministry of Economic Development, 2021). Meanwhile, Belgium, although smaller in size, benefits from its central role in EU-level regulatory innovation and finance-related policy, offering a unique environment for public–private collaboration on skills development. These dynamics make all four countries critical to understanding how apprenticeships can support the development of the Fintech workforce, especially by combining hands-on digital skills training with sector-specific expertise in compliance, cybersecurity and data analysis (European Commission, 2020). This growth is particularly reflected in the increasing number of job postings for roles that combine traditional financial expertise with advanced technological skills. To select and analyse the job postings data, we applied a set of keywords specifically designed to capture the Fintech sector across different languages and regions in Europe. The keywords used to filter the job postings include terms such as 'Fintech', 'digital banking', 'blockchain', 'cryptocurrency', 'payment gateways', 'financial technology' and 'Insurtech'.

The data show that, in 2023, personal financial advisors were the most in-demand occupation within the Fintech sector, with 4 169 unique postings (Table 4). This reflects the increasing reliance on technology to deliver personalised financial services, such as automated investment advice and digital wealth management platforms. The demand for accountants and financial analysts follows closely, with 3 378 and 2 885 postings, respectively, illustrating the sector's need for professionals who can navigate both traditional financial practices and emerging digital tools.

Figure 3. **Fintech – job posting trends in selected EU Member States**



Source: Lightcast global postings.

Demand for compliance-related roles, as indicated by the 2 449 unique postings for compliance officers/analysts, can be attributed to the increasingly complex regulatory landscape in the financial services industry, particularly around issues such as data security, anti-money laundering and compliance with digital transaction regulations. Fintech firms require these professionals to ensure that their innovative products and services align with regulatory standards, which is becoming more critical as digital financial products proliferate.

In addition, roles such as treasurers/controllers (1 930 postings) and bookkeepers / accounting clerks (1 299 postings) continue to be central to the operation of Fintech businesses by managing finances, budgets and records in an increasingly digitised environment. The demand for auditors (1 032 postings) and fraud examiners/analysts (945 postings) underscores the importance of ensuring financial integrity and preventing fraud in the digital age, when financial crime is becoming more sophisticated and widespread.

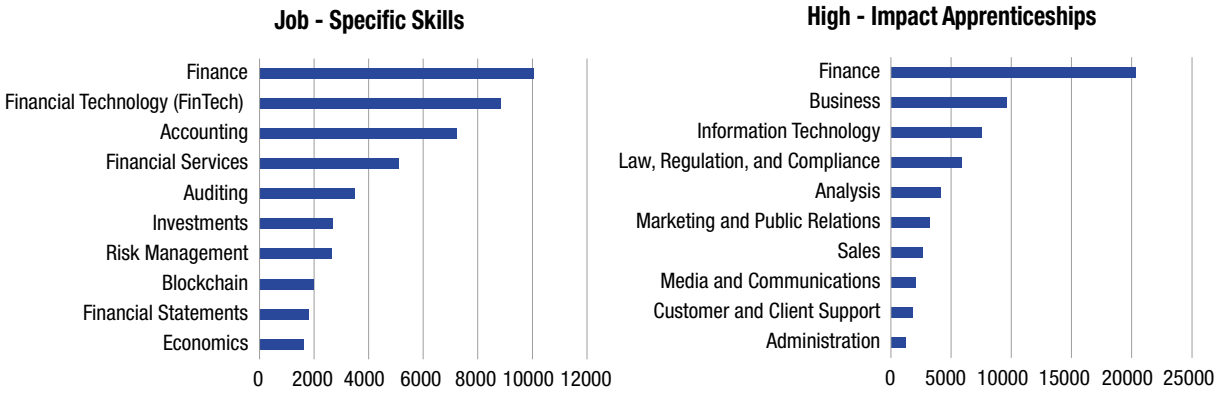
Table 4. **Top 10 core occupations related to the Fintech sector**

Occupation	Unique postings (2023)
Personal financial advisor	4 169
Accountant	3 378
Financial analyst	2 885
Compliance officer/analyst	2 449
Treasurer/controller	1 930
Bookkeeper / accounting clerk	1 299
Auditor	1 032
Securities/commodities trader	996
Fraud examiner/analyst	945
Financial services sales agent	754

Source: Lightcast global postings.

Figure 4 highlights a clear demand for both traditional financial skills and emerging technological competences in the Fintech sector. Finance remains dominant both among job-specific skills and those relevant to high-impact apprenticeships. However, the increasing significance of business, IT and regulatory compliance skills points to a growing need for interdisciplinary expertise. Apprenticeships are particularly effective in these areas, offering practical pathways to develop the skills required for success in a rapidly evolving digital economy. The integration of technology into financial services, while still emerging, is poised to become a more prominent focus in future apprenticeships.

Figure 4. **Most in-demand skills: job-specific and high-impact apprenticeship skills in Fintech occupations, Europe, 2023 (unique postings)**



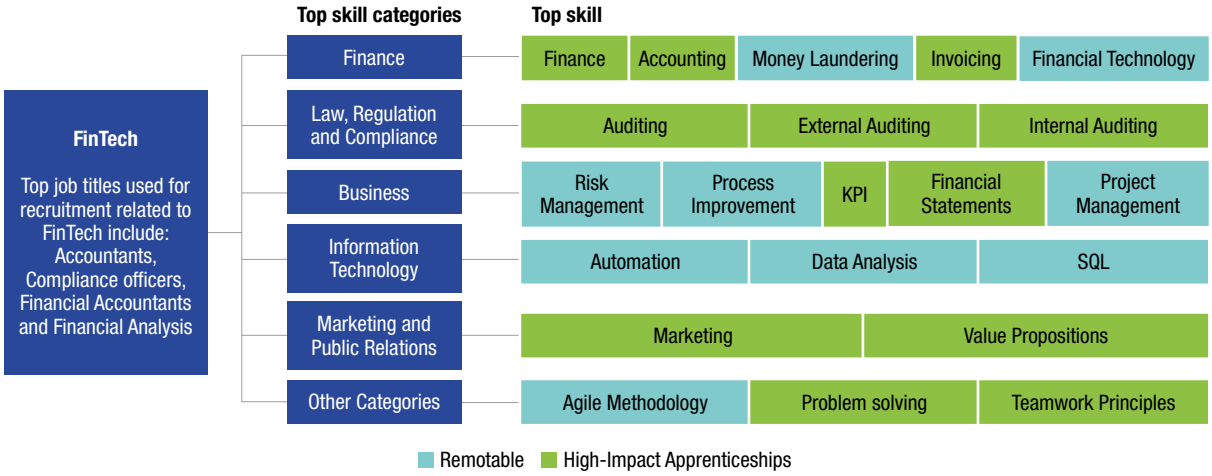
Source: Lightcast global postings.

The data presented in Figure 5 illustrate the framework skill set within the Fintech sector, emphasising the importance of finance, law, compliance and IT. Finance-related skills such as those in accounting, auditing and Fintech appear among the top skills, reflecting their critical role in the industry. Skills such as in anti-money laundering and risk management also highlight the sector's regulatory complexity and the need for professionals adept in navigating compliance frameworks. Technical skills such as automation, data analysis and using SQL (structured query language) underscore the increasing integration of technology within financial services, signalling a growing demand for professionals skilled in digital

transformation. Non-technical skills, such as project management and process improvement, are also key to ensuring operational efficiency for Fintech firms.

This framework helps align educational pathways – such as VET programmes in finance or IT – with apprenticeship models, which are better suited for roles requiring practical, on-the-job learning experiences. This approach ensures that individuals acquire the specific expertise needed to meet the demands of the Fintech industry.

Figure 5. **Skills framework for apprenticeships in the Fintech sector, Europe, 2023 (unique postings)**



NB: KPI, key performance indicator; SQL, structured query language.

Source: Lightcast global postings.

1.3.2. Cybersecurity

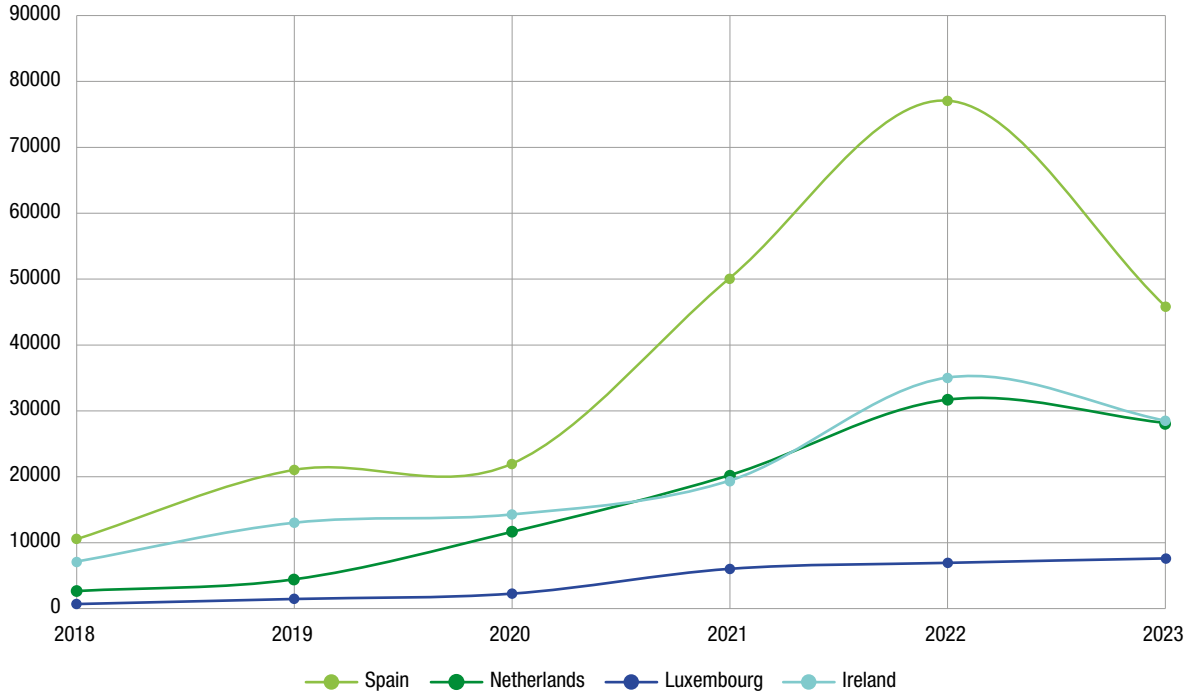
The data on cybersecurity job postings from 2018 to 2023 in four selected EU Member States highlight significant fluctuations and growth in demand for cybersecurity professionals (Figure 6). Europe, as a whole, saw substantial increases with a peak in 2022, when unique job postings reached over 4.16 million (Lightcast database). This spike probably reflects the intensified focus on digital security due to the accelerated digitalisation caused by the COVID-19 pandemic, along with rising cyber threats across industries.

The selection of Ireland, Spain, Luxembourg and the Netherlands for the analysis of cybersecurity-related job postings is supported by both strong growth in demand and national efforts to develop cybersecurity talent pipelines, including through apprenticeships and work-based learning. Between 2018 and 2023, all four countries saw substantial increases in cybersecurity job postings, reflecting the sector's strategic importance and rapid digitalisation. Spain recorded a sevenfold increase, from 10 539 postings in 2018 to 77 076 in 2022. This growth aligns with Spain's cybersecurity strategy for 2019–2025, which highlights the need for professional training pathways and digital upskilling, including dual VET models (INCIBE, 2021). The Netherlands saw steady growth in demand, reaching over 28 000 postings in 2023. The Dutch Cyber Security Council has called for stronger investment in talent, while the country's secondary vocational education system increasingly supports work-based pathways in IT and cybersecurity (Dutch Cyber Security Council, 2022). Luxembourg shows high per capita demand and has invested in workforce development through the Cybersecurity Skills Academy, launched by the European Commission in 2023 to support both initial training and professional reskilling via modular and work-integrated learning formats. Ireland, a European hub for tech multinationals, saw an increase from 7 129 postings in 2018 to 35 053 in 2022. Ireland's national cybersecurity strategy (Government

of Ireland, 2020) and the generation apprenticeship programme, led by the Irish Further Education and Training Authority (SOLAS), offer apprenticeship routes in areas such as cybersecurity, IT networking and cloud infrastructure, blending formal instruction with employer-based learning (Whelan et al., 2024).

Looking at 2023 data, the trends suggest that, while cybersecurity remains a critical priority across Europe, the rapid growth of 2022 has slowed down, possibly reflecting saturation or adjustments in hiring practices as firms adapt to new security landscapes.

Figure 6. **Cybersecurity – job posting trends in Europe**



Source: Lightcast global postings.

Table 5 highlights the key occupations central to the cybersecurity sector, with cybersecurity / information security engineers and analysts emerging as the most critical roles, reflecting the increasing emphasis on protecting digital infrastructures. Alongside these, the demand for software developers/ engineers and computer support specialists signifies the need for both proactive system development and ongoing technical support. Roles such as network/system administrators and network engineers/ architects further underscore the importance of maintaining secure and resilient networks. Additionally, the presence of business intelligence analysts indicates the growing intersection of data analysis and cybersecurity, emphasising the need for data-driven approaches to address evolving security challenges.

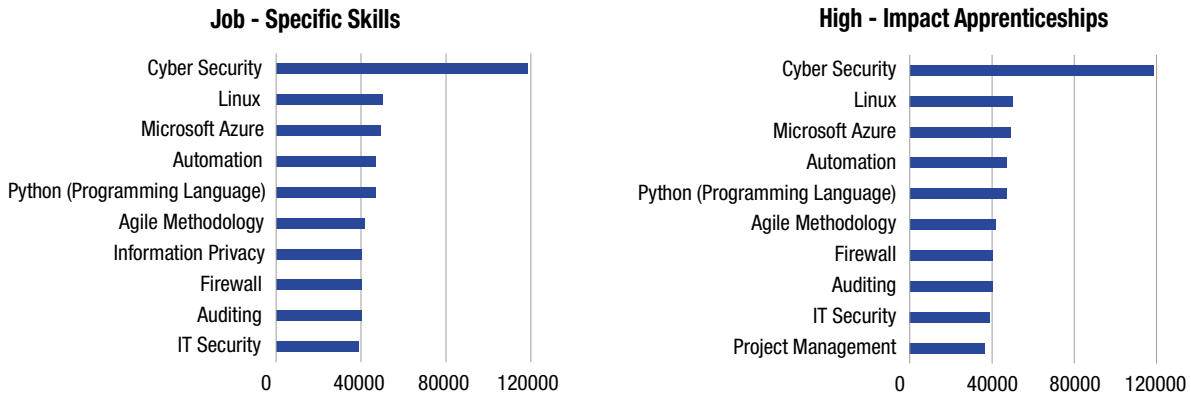
Table 5. **Top 10 core occupations related to the cybersecurity sector**

Occupation	Unique postings (2023)
Cybersecurity / information security engineer/analyst	95 065
Software developer/engineer	75 450
Computer support specialist	61 194
Network/systems administrator	32 985
Computer systems engineer/architect	30 009
Network engineer/architect	19 945
Technology consultant	19 762
Web developer	11 495
Database architect	10 423
Business intelligence analyst	9 498

Source: Lightcast global postings.

Figure 7 highlights the most in-demand skills within the cybersecurity sector, with cybersecurity clearly standing out as the top job-specific skill and a key focus for high-impact apprenticeships. Other critical skills, such as Linux and Microsoft Azure, underscore the reliance on operating systems and cloud platforms, which are important for managing secure networks and data storage. Automation and Python (the programming language) are also prominent, reflecting the sector's increasing emphasis on automating security processes and leveraging programming expertise to build and maintain secure systems. The inclusion of agile methodology suggests a demand for flexible, iterative approaches to project management, which are essential in responding to evolving security threats.

Figure 7. **Most in-demand skills: job-specific and high-impact apprenticeship skills in cybersecurity occupations, Europe, 2023 (unique postings)**

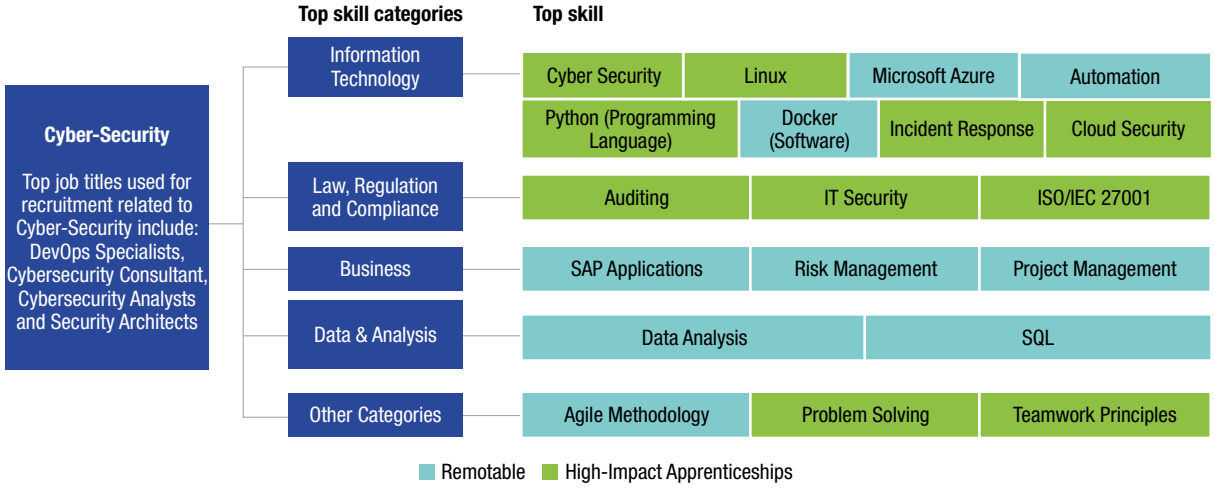


Source: Lightcast global postings.

The skills framework for technical and vocational education and training and apprenticeships in cybersecurity, as depicted in Figure 8, highlights a balance between technical competences and essential workplace skills. Key technical skills, such as cybersecurity, Linux, Microsoft Azure and Python, are foundational for roles such as cybersecurity consultants and security architects. These skills are well suited to apprenticeships, as hands-on training is crucial for mastering tools such as those related to

incident response and cloud security. The framework emphasises the importance of compliance and regulatory expertise, with auditing and IT security skills, among other skills, and International Organization for Standardization / International Electrotechnical Commission (ISO/IEC) 27001 certification, being high-impact areas for apprenticeships. Soft skills such as problem-solving, using the agile methodology and teamwork are highlighted, illustrating the need for apprentices to develop not only technical acumen but also the ability to work effectively within teams and adapt to dynamic project environments. These skills, while less technical, are indispensable for the holistic development of cybersecurity professionals. Overall, the framework aligns apprenticeships with both industry needs and the practical demands of the cybersecurity field, preparing students for real-world challenges.

Figure 8. **Skills framework for apprenticeships in the cybersecurity sector, Europe, 2023 (unique postings)**



NB: SAP, Systems, applications and products software. SQL, structured query language.

Source: Lightcast global postings.

1.3.3. Education

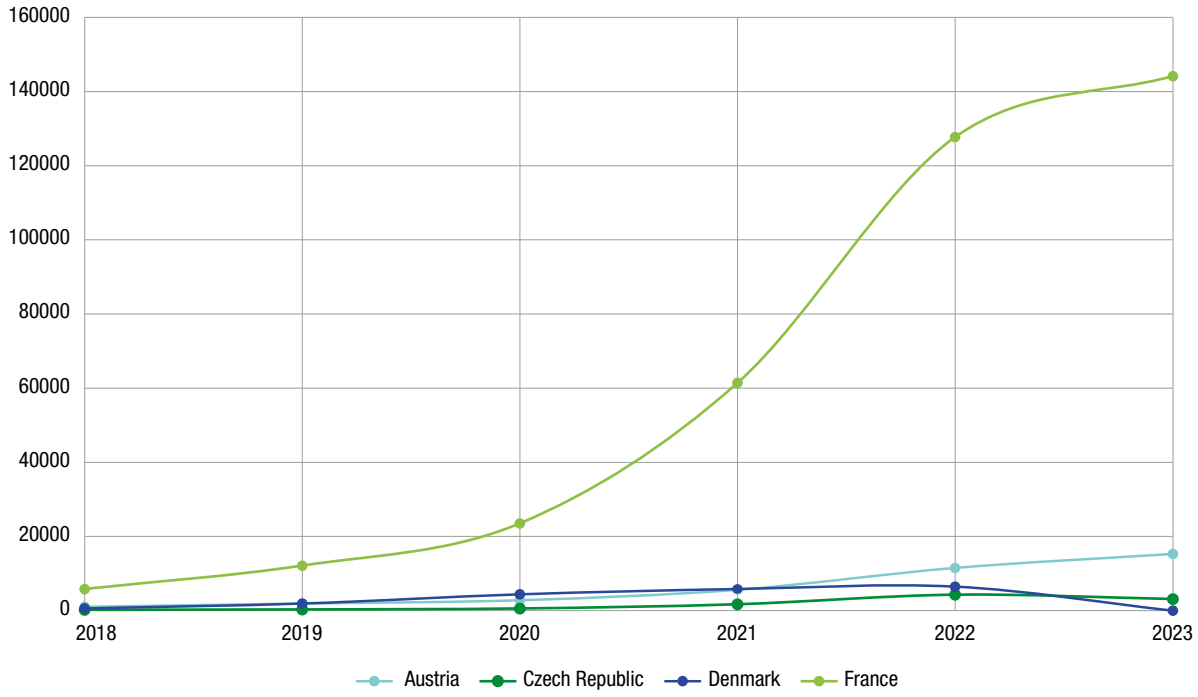
The data in Figure 9, presented across various EU Member States from 2018 to 2023, provide insight into the trends and developments in education sectors specific to technology and special needs. This analysis does not aim to capture the entire education sector. It focuses specifically on selected subdomains within education where apprenticeships and vocational training pathways are increasingly relevant, namely teaching support, childcare, special education and technology-enhanced learning (e.g. educational technology).

The selection of Czechia, Denmark, France and Austria for analysis in the education sector is supported by both labour market demand trends and active policy efforts to modernise education and expand vocational pathways, including through apprenticeships in teaching and educational support roles. Between 2018 and 2023, significant increases were recorded in education-related job postings. France, in particular, showed a dramatic rise, from just over 5 800 postings in 2018 to more than 144 000 in 2023, driven by national reforms in education, demographic pressures and a teacher shortage crisis. In response, the French government introduced new apprenticeship pathways into teaching, including *préprofessionnalisation* contracts for assistants and early-career educators, particularly in in selected geographical areas (priority education zones, *zones d'éducation prioritaire*) (Ministère de l'Éducation Nationale, 2023). Austria also experienced steady growth, with postings rising from 1 055 in 2018 to over 15 000 in 2023. The country operates a well-developed dual education system, and recent efforts have focused on integrating pedagogical roles within vocational training, especially in childcare and

special education support (BMBWF, 2022). In Czechia, job postings in education rose significantly, from just 224 in 2018 to over 3 000 in 2023, reflecting increasing investment in early childhood and inclusive education. Policy strategies under the strategy for education policy 2030+ promote the diversification of education careers and recognise practical training models as key to workforce development (Czech Ministry of Education, Youth and Sports, 2020). Denmark, with a strong tradition of work-based learning, has also seen job postings nearly double since 2019. Its *Erhvervsuddannelser* (EUD) vocational education framework includes apprenticeships in childcare, pedagogical assistance and youth education roles, supported by national labour market forecasts and inclusion strategies (Danish Ministry of Children and Education, 2023). The growing emphasis on integrating technology into education is evident, particularly in countries such as Denmark, France and Austria, where the education landscape has increasingly adapted to digital tools and inclusive approaches to special needs education.

The presence of consistent data points across these countries signals an increasing recognition of the importance of both technology-driven learning and special education, two fields that require substantial investments in resources and teacher training. The methodologies used to generate these insights involved filtering job postings and educational programme descriptions using a comprehensive set of keywords. These keywords included terms specific to educational technology (e.g. 'Edtech', 'digital learning', 'virtual classrooms' and 'learning management systems') and special needs education (e.g. 'special education', 'assistive technology', 'inclusive education' and 'individualised education programme'). By filtering job postings and programme data by these keywords in various languages, we were able to capture the demand and growth trends specific to technology adoption and special education needs across different educational systems.

Figure 9. **Education – job posting trends in Europe**



Source: Lightcast global postings.

The top occupations in education for 2023 (Table 6) include the essential roles of teacher assistants and special education teachers, where apprenticeships offer vital hands-on experience, particularly in supporting diverse learners. Apprenticeships in these roles enable educators to develop practical skills

in real classroom settings, especially in terms of working with students with special needs. Similarly, roles such as curriculum designers and preschool teachers benefit from apprenticeships because they enable the integration of educational technology and inclusive methodologies into teaching practices. For vocational and adult education instructors, apprenticeships provide crucial exposure to adapting educational approaches to meet the needs of different learners, preparing instructors to deliver more effective, skills-oriented training. Apprenticeships significantly enhance practical competences in education, ensuring that professionals are equipped to support people with diverse educational needs.

Table 6. **Top 10 core occupations related to the education sector**

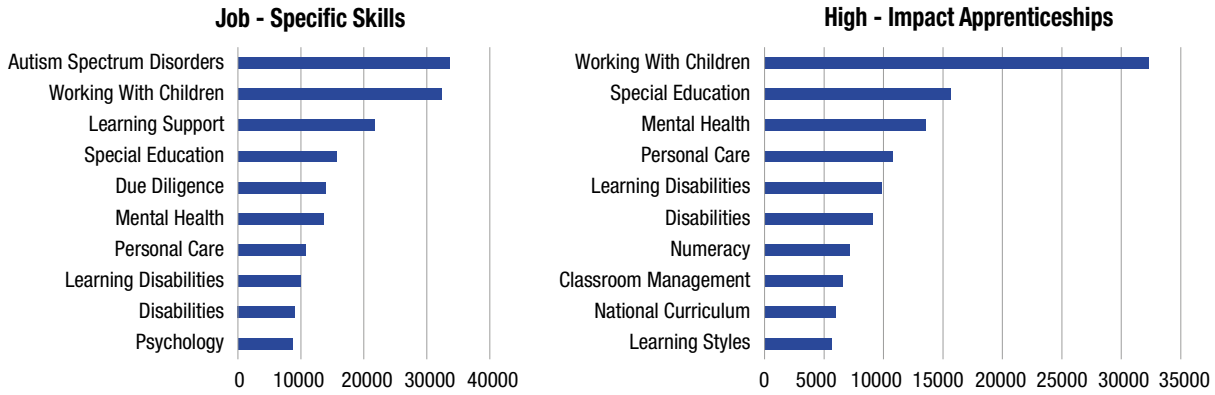
Occupation	Unique postings (2023)
Teacher assistant	67 771
Special education teacher	34 429
Tutor	7 891
Preschool/childcare teacher	6 929
Elementary school teacher	5 278
Curriculum and instructional designer/developer	5 216
Maths teacher	1 620
Bilingual / ESL / foreign language teacher	1 609
Vocational education instructor	855
Adult basic education / literacy instructor	240

NB: ESL, English as a second language.

Source: Lightcast global postings.

Figure 10 presents the top skills required in the education sector, particularly for roles supporting people with special needs and child development. Autism spectrum disorder and working with children emerge as top job-specific skills, reflecting the growing need for professionals equipped to work with people with diverse learning needs and disabilities. The prominence of learning support and special education skills underscores the importance of educators being trained in providing tailored educational assistance, especially in inclusive settings. Skills related to learning disabilities, classroom management and understanding the national curriculum are also highlighted as essential, reinforcing the importance of blending pedagogical knowledge with real-world application in apprenticeships. This alignment between job-specific and apprenticeship skills shows that practical, immersive training plays a vital role in preparing professionals to support students with complex needs.

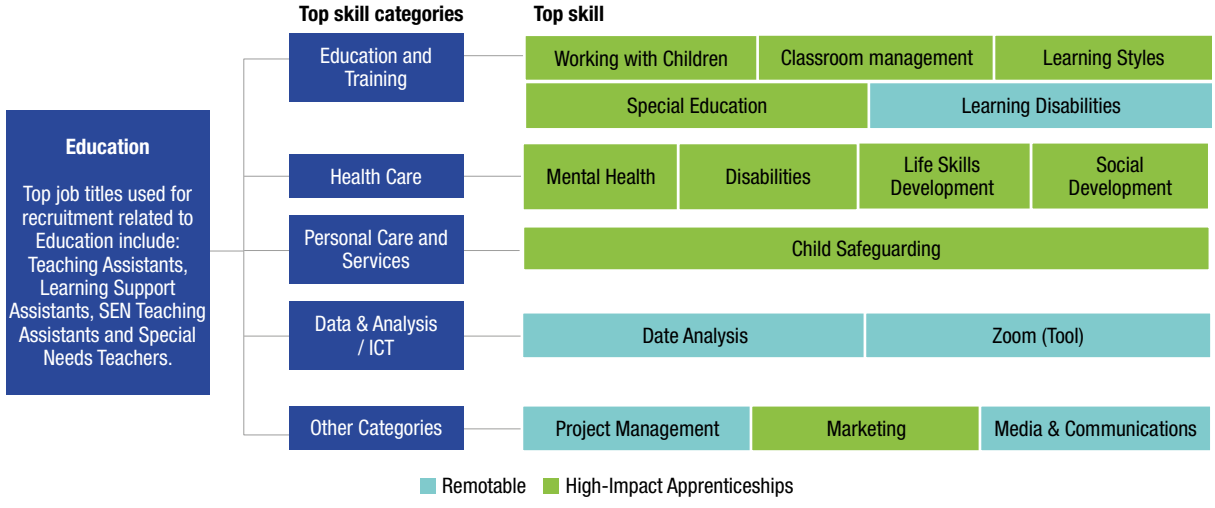
Figure 10. **Most in-demand skills: job-specific and high-impact apprenticeship skills in education occupations, Europe, 2023 (unique postings)**



Source: Lightcast global postings.

The skills framework for education highlights key competences such as those related to working with children, classroom management and special education, which are essential for supporting diverse student populations (Figure 11). Practical skills such as those related to mental health, social development and child safeguarding are also critical, particularly in special needs education, where hands-on experience is vital. The inclusion of technical skills such as data analysis and the use of tools such as Zoom shows the increasing role of technology in education. Apprenticeships play a crucial role in equipping educators with these skills through practical, on-the-job learning, bridging the gap between theory and real-world application in the classroom.

Figure 11. **Skills framework for apprenticeships in the education sector**



NB: ICT, information and communications technology; SEN, special education needs.

Source: Lightcast global postings.

1.4. Conclusions

This paper has illuminated the significant potential for expanding apprenticeships into emerging sectors such as Fintech, cybersecurity and educational technology, areas that have experienced rapid growth due

to technological advancements and the digitalisation of industries. Our quantitative findings suggest that apprenticeships, traditionally associated with more manual or technical trades, are increasingly relevant in sectors requiring a combination of advanced technical and soft skills. This shift in vocational training models reflects the evolving nature of work, where hands-on experience and real-world application of skills are as important as formal education, particularly in high-growth, technology-driven sectors.

In Fintech, for example, the demand for skills such as financial analysis, compliance with financial regulations and automation in financial services highlights the necessity for training models that combine theoretical knowledge with practical expertise. Apprenticeships provide an avenue for learners to develop these competences in real-world settings, offering a pathway to bridge the gap between education and employment. Similarly, in cybersecurity, roles such as cybersecurity analyst and information security engineer require a nuanced understanding of security protocols, legal frameworks and technical infrastructure. Apprenticeships enable learners to engage directly with these challenges, developing critical problem-solving and analytical skills through immersive, practical experience. In the educational technology sector, apprenticeships can help educators and curriculum designers to integrate digital tools and platforms effectively into the learning environment. As the sector continues to expand, with increased reliance on virtual classrooms and digital learning management systems, apprenticeships offer a practical route for professionals to acquire the digital literacy and technical skills necessary to adapt to this evolving landscape.

Our analysis underscores that apprenticeships are not only a means to address current skills gaps but also a strategic tool to mitigate the widespread talent shortages across Europe. As indicated by Eurostat data, a significant portion of the workforce lacks the digital and advanced technical skills that are increasingly in demand across industries. Apprenticeships offer an immediate solution by aligning vocational training with the real needs of the labour market, providing a clear pathway for individuals to acquire in-demand skills while addressing the talent gap in critical sectors such as Fintech and cybersecurity.

The integration of big data analytics and generative AI in apprenticeship frameworks enables the creation of more targeted, adaptable training models that can evolve alongside industry needs. By using AI to measure skill success ratios and identify the most relevant competences for specific roles, education providers can tailor apprenticeship programmes more effectively, ensuring that they meet the demands of both learners and employers.

To fully leverage the potential of apprenticeships in emerging sectors, VET providers must prioritise the integration of advanced technologies, such as AI and data analytics, into their curriculum development processes. This will allow for more responsive and flexible training models that align closely with the needs of fast-evolving industries. Furthermore, VET institutions should expand partnerships with private-sector employers to ensure that apprenticeship programmes are grounded in practical, real-world applications and reflect the latest industry trends and challenges.

VET providers must also focus on creating interdisciplinary programmes that bridge the gap between technical skills, such as coding and cybersecurity skills, and soft skills such as communication, teamwork and problem-solving. These holistic training models will not only improve the employability of apprentices but also equip them with the versatility required to navigate the complexities of the modern labour market.

In conclusion, the expansion of apprenticeships into new sectors represents a significant opportunity for addressing Europe's talent shortages while simultaneously preparing the workforce for the challenges of a rapidly changing economic landscape. By adopting innovative approaches to VET, particularly using AI and big data analytics, VET providers can ensure that their programmes remain relevant, adaptive and impactful in supporting the development of a skilled, future-ready workforce.

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CHAPTER 2.

A multilevel exploration of the first non-traditional honours degree apprenticeship in Ireland

By Bryan Coyne ([2]), Brendan O'Mahony, Esther Quinn, Fergal Keane, Denis Haran ([3]) and Anne McGlynn ([4])

2.1. Introduction

Apprenticeships seek to be an affordable and accessible pathway to higher education, developing graduates with sector-relevant skills (HEA, n.d.). Apprenticeships help improve labour market outcomes, reduce skills mismatches, promote greater representation and support flexible, lifelong learning. Degree apprenticeships provide a widely recognised qualification that serves as a passport to opportunity. A significant policy shift across many developed economies has been the expansion of apprenticeships into non-traditional, non-craft sectors.

In Ireland, the insurance practitioner apprenticeship was the first non-traditional honours degree apprenticeship designed to meet industry needs. The Irish insurance sector accounts for 1 in 4 jobs in the financial services sector (Insurance Ireland, 2020), employing 35 000 people and contributing over EUR 2.7 billion annually to the Irish exchequer. Insurers in Ireland paid more than EUR 68 billion in claims in 2022 and help safeguard some EUR 300 billion of life and pensions assets. Ireland has the fourth largest insurance industry in the EU (measured by premiums), with over EUR 102 billion in gross premiums written in 2022 (Culligan et al., 2023).

Ireland has undergone a significant change in the provision and uptake of apprenticeships. In 2016, over 80 % of qualified apprentices were in traditional industries – electrical (36.1 %), motor (25.4 %) and construction (20.1 %) – with over half of qualified apprentices being under 25 years of age and fewer than 100 being female from 2010 to 2016 (CSO, 2022a). A government review recommended expanding apprenticeship to 'new' sectors, including information and communications technology, retail, business administration, leisure and childcare, through collaboration between enterprise consortia ([5]), education providers and government (Government of Ireland, 2013). The 2021–2025 action plan for apprenticeship seeks to expand and increase apprenticeship in Ireland (DFHERIS, 2021). As of December 2023, this target was on track, with 27 470 apprentices across craft trades (23 140, 84 %) and consortia-led, non-traditional apprenticeships (4 330, 16 %) (NAO, 2024).

Employers' demand for and engagement with apprenticeship is a key enabler of such programmes (IGEES, 2019). For employers, apprenticeship provides an essential pipeline of talent and a pathway to collaborate with universities to inform curricula (WECD, 2019) and equip graduates with the knowledge and skills required for their industry, while placing employers at the heart of the apprenticeship system (Daley et al., 2016). Research has noted that managers benefit from apprentices adding value when apprentices translate new knowledge and skills into their workplace (Quew-Jones, 2022). A national survey of apprenticeship employers found that 87 % were satisfied with their experience, with 47 % citing employee upskilling as a main motivator for hiring apprentices (NAO, 2023).

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([5]) A consortium-led apprenticeship is industry driven, is led by employers and includes coordinating providers.

Degree apprenticeships have helped attract new talent, tackled gender stereotyping, encouraged inclusion and widening participation and demonstrated an apprenticeship can be equal in esteem to more traditional academic routes for both new and existing employees.

Source: Crawford-Lee & Moorwood, 2019.

Research has identified high levels of skill underutilisation among Irish employees, with education attainment exceeding job requirements compared with EU peers (McGuinness et al., 2018). New apprenticeships help improve labour market outcomes by providing relevant skills that can reduce skills mismatches, which can have adverse impacts on individuals, firms and the economy (IGEES, 2019). Apprenticeships are particularly needed in non-traditional sectors, with the service sector accounting for 77 % of employment (CSO, 2022b).

2.1.1. Evidence on degree apprenticeship

Degree apprenticeships carry the weight of expectations of multiple stakeholders. They are expected, for instance, to meet economic needs and those of employers; to increase social mobility and diversity in higher education; to bridge the gap between different levels of qualifications; to create a new gateway to the professions; and to imbue a vocational route to education with the prestige accorded to more conventional routes.

Source: Office for Students, 2019.

The formal academic award is a key aspect of degree apprenticeship. Degree apprentices value the combination of theoretical and practical learning, enhanced employment prospects and the ability to gain a degree while working without debt (Engeli & Turner, 2019). Engeli and Turner (2019) found the top motivation for UK apprentices was obtaining a degree alongside earning a salary. The degree qualification 'is a crucial part of the standard and without it they [employers] would not attract the talent they need, thus affecting the very purpose of the apprenticeship' (Crawford-Lee, 2020). For apprentices, a degree apprenticeship represents a debt-free higher education pathway and a stepping stone to a career or future education (Crawford-Lee & Wall, 2018).

A vital aspect of degree apprenticeship is work-based learning. Boud and Solomon (2001, p. 1) draw upon evidence from Australia and the United Kingdom to argue that degree apprenticeship is 'one of the very few innovations related to the teaching and learning aspects of post-secondary education that is attempting to engage seriously with the economic, social and educational demands of our era'. Degree apprenticeships provide a practice-based academic qualification, which involves developing professional competence (Bravenboer & Lester, 2016), while the blend of work-based learning and academic theory 'facilitates strong employment outcomes for graduates from these programmes' (Cooper et al., 2010). Antcliff et al. (2016) studied the first degree apprenticeship in the United Kingdom and found that it represents excellent value for money and meets recruitment needs in a unique way, by providing an instant contribution to the workplace. Smaller employers benefit from university support structures while also being able to inform curricula.

Degree apprenticeships serve to widen participation and improve social inclusion in higher education (Bradley et al., 2019). They attract a higher proportion of mature learners who may not otherwise have considered higher education (Engeli & Turner, 2019; WECD, 2019). Conversely, Casey et al. (2022) observe that the degree apprenticeship route for solicitors is often perceived as unfamiliar and risky by respondents from disadvantaged backgrounds. A UK study of computing degree apprentices found considerable diversity across socioeconomic groups, meaning that such apprenticeships provide access to new learners and upskillers (Smith et al., 2021).

2.1.2. BA (Hons) insurance practitioner apprenticeship

In Ireland, the insurance practitioner apprenticeship commenced in 2016, when a global insurance company with experience of the apprenticeship model approached the Insurance Institute of Ireland to develop a degree apprenticeship in Ireland. A consortium of the Atlantic Technological University Sligo, the Insurance Institute of Ireland, several large insurers and industry experts was formed. The apprenticeship pathway was chosen to improve early-career employees' access to the sector while also providing apprentices with professional qualifications and an opportunity to earn a degree. The apprenticeship should be a three-year honours degree with four days of work and one day attending college online with a higher education provider (i.e. 80 % work-based learning), with embedded technical qualifications. In September 2016, the BA (Hons) in insurance practice became the first non-traditional national framework of qualifications level 8 (European qualifications framework level 6, International Standard Classification of Education levels 665 and 667) honours degree apprenticeship in Ireland. Twelve months later, the programme expanded to include life insurance businesses, when the Life Insurance Association joined the consortium. A key benefit of the apprenticeship is an additional technical qualification earned alongside the degree. General insurance apprentices earn the Certificate in Insurance Practice (Insurance Institute of Ireland, n.d.) and life insurance apprentices earn a qualified financial adviser qualification (Life Insurance Association Ireland, n.d.). Since its inception, there has been over 200 graduates. In the ninth intake of apprentices, in 2024, there was a strong gender balance, with 51 % being female and 49 % being male, and a diverse age profile of learners, ranging from 18 to 55. As of September 2024, the course had 460 apprentices, spread across three year groups, reflecting its importance for the industry.

2.1.3. Research focus and objective

This work seeks to address the lack of research on degree apprenticeship outcomes using an exemplar case study. It quantifies the benefits and challenges of the apprenticeship model based on the BA (Hons) insurance practitioner apprenticeship. It explores the perspectives of three key stakeholders: graduates of the apprenticeship, employers that supported the apprenticeship and current apprentices. Responses explore the decision to enrol, the apprenticeship experience, current employment, the value of the apprenticeship model and qualifications earned (Table 7).

Table 7. **Survey overview**

Section	Subsample	Survey questions
Introduction and consent	All participants	Q1–Q3
1. Demographics and education journey	Graduates	Q4–Q10
2. Current employment	Graduates	Q11–Q20
3. Reflection on apprenticeship experience	Graduates	Q21–Q31
1. Context	Employers	Q32–Q40
2. Reflection on apprenticeship qualification	Employers	Q41–Q47
3. Reflection on apprenticeship experience	Employers	Q48–Q57
1. Demographics and education journey	Apprentices	Q58–Q62
2. Current employment	Apprentices	Q63–Q71
3. Reflection on apprenticeship	Apprentices	Q72–Q82

Source: The authors.

A thematic analysis of qualitative sentiment obtained using open-ended questions provides detailed perspectives. Descriptive analysis of graduate outcomes using national averages compares economic

outcomes. This research provides significant public good as the first NFQ level 8 (EQF level 6) non-craft honours degree apprenticeship in Ireland. Despite the focus on 'new' apprenticeships, relatively little is understood about the views and outcomes of apprentices, graduates and employers. This is particularly important given policymaker ambition and the prominence of the Irish service sector. Results can help inform policy affecting apprenticeships worldwide.

2.2. Methodology

This study adopts an inductive qualitative methodology grounded with an interpretivist epistemological stance, with results that explore depth of meaning in participant views (Bryman, 2012). Research has noted that the student voice is often overlooked (McCoy et al., 2016). This case study investigates a phenomenon in depth and within its real-life context (Yin, 2009, p. 18). Ethics approval was granted by the Atlantic Technological University Sligo Research Ethics Committee.

Anonymous online qualitative surveys enable quantitative analysis of closed-ended responses and thematic analysis of open-ended responses. Qualitative surveys have been underutilised due to misplaced assumptions regarding such surveys lacking depth compared with in-person interviews (Braun et al., 2021). They have a wide reach in terms of the target population and obtain rich individual-level data (Table 8). They are ideal for collecting views from geographically dispersed respondents. Open-ended questions allow detailed perspectives (Braun et al., 2021), while closed-ended questions provide accessibility for participants (Jakob & Fugerson, 2012) and facilitate quantitative analysis. Thematic analysis is a flexible approach (Braun & Clarke, 2006) involving the review of responses and coding of emergent themes using Microsoft Excel (Bree & Gallagher, 2016).

Table 8. **Overview of methodological considerations**

Criteria for use of a qualitative survey (Braun et al., 2021)	Steps of thematic analysis (Braun & Clarke, 2006)
Best fit for participants' needs (e.g. sensitive topics)	1. Familiarising oneself with the data
A population is geographically dispersed	2. Generating initial codes from the data
A population is hard to engage or access	3. Searching for themes within the data
A wide range of perspectives are sought	4. Reviewing themes
The topic suits a 'wide-angle' lens	5. Defining and naming themes
The focus of the study is quite specific	6. Producing the report

Source: The authors.

Purposive sampling involves (a) current apprentices, (b) graduates and (c) employers involved in the insurance apprenticeship programme. Graduates were contacted by a gatekeeper through their respective industry body. Current apprentices were contacted using their college details. Employers were contacted through their apprenticeship engagement. Social media (e.g. LinkedIn) was also used to invite potential participants. Initial contact outlined the purpose of the study and procedures surrounding anonymity, data security and withdrawal rights. Participants affirmed their consent prior to accessing the survey.

2.2.1. Sample overview

The final sample features 117 valid responses (Table 9) collected between 1 November 2022 and 27 November 2022. The average apprentice age of 25.60 years (Table 9) suggests that many students do not come directly from secondary-level education. There is a greater share of female respondents (57 % for female apprentices, 72 % for female graduates). 97 % of graduates report being in full-time employment at the time of questioning.

Table 9. **Sample profile and overview of methodological considerations**

	Average age (years)	*n*	% frequency
Current apprentices	25.60	42	35.90 %
Male		18	42.86 %
Female		24	57.14 %
Graduates	27.13	39	33.33 %
Male		11	28.21 %
Female		28	71.79 %
Employers	Not applicable	36	30.77 %
Grand total	26.33	117	100.00 %

Source: The authors.

In terms of modality, almost two thirds (60 %) of apprentices and graduates report a hybrid working arrangement (Table 10, Figure 12), while roughly a quarter (23 %) report working fully in an office. These results echo national data, with 59 % of workers having hybrid working arrangements and 38 % working fully remotely, among almost 6 000 respondents (McCarthy et al., 2023).

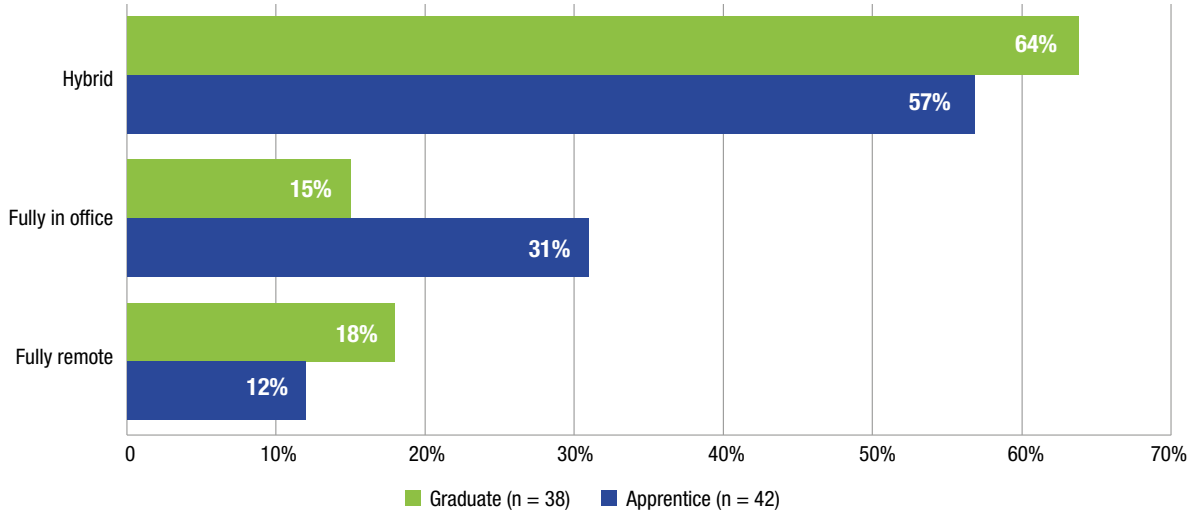
Table 10. **Work modality**

Category	Number of apprentices	Number of graduates	Total
Hybrid	24 (57 %)	25 (64 %)	49 (60 %)
Fully in office	13 (31 %)	6 (15 %)	19 (23 %)
Fully remote	5 (12 %)	7 (18 %)	12 (15 %)
Grand total	42 (100 %)	38 (97 %)	80 (99 %)

NB: The results exclude one graduate, who did not respond to the question.

Source: The authors.

Figure 12. **Reported base for work (apprentices, n = 42; graduates, n = 38)**



NB: The results exclude one graduate, who did not respond to the question.

Source: Authors' calculations.

2.3. Findings

Section 2.3.1 presents thematic evidence from graduates and apprentices, encompassing the decision to enrol, their experience and their perceived employability. Section 2.3.2 details the employer apprenticeship experience and how it supports employers' talent strategies. Section 2.3.3 compares the economic performance of graduates with national averages.

2.3.1. **The degree apprenticeship experience**

2.3.1.1. *Enrolment decision*

Apprentices enrol due to a desire to earn a qualification, career ambitions and financial concerns. Many respondents identified earning a qualification as a key influence. Apprentices who enrolled directly from secondary school and some who had previously worked without any formal qualifications were experiencing tertiary-level education for the first time. Several had negative prior experiences in higher education due to choosing the wrong course for them or having difficulties adapting. Apprenticeship offers a chance to earn a degree in better circumstances. Some also mention the technical qualifications as influential.

> I had dropped out of college (my number one choice on CAO [Central Applications Office]) and was unsure what to do. Going back to college would've been very expensive …

Source: Apprentice.

Financial considerations were mentioned, including the prohibitive cost of attending college through traditional routes, with the opportunity to work and earn while studying being considered to widen access. Some respondents had industry contacts through family or friends while others sought a career change or found the apprenticeship online. Career progression played a significant role in the enrolment decision for many, with insurance being viewed as an attractive sector.

> [A] new career path which was much more appealing due to the college aspect of getting fully qualified whilst working full time.

Source: Apprentice.

2.3.1.2. *Experience*

The most positive aspect cited is the ability to earn while gaining qualifications. Respondents note how this model provided access to education that otherwise might not have been accessible to them. Relevant course content, online delivery and alignment with work experience were also regarded as positives.

> It is good to get a stable salary while learning. Before I took this course I wanted to go back to college and there was no way I was going to be able to afford that on my own so that is also a positive.

Source: Apprentice.

Many graduates value the opportunities within the programme to develop lasting relationships with fellow apprentices and across the industry. Some felt that this would be beneficial in their future career.

> I have to say this course was so relevant to the working life which was great, other courses have a detachment from the real world, but this one was very well linked to what education we needed in the workplace.

Source: Graduate.

Apprentices cite workload, particularly the timing and amount of assessment, as a challenge. Some participants suggested tailoring the course to more specific industry areas, while others suggested fewer submission points.

> I don't think either the college or employers are very considerate of the heavy workload we have and the amount of stress we are under at times.

Source: Apprentice.

In the workplace, some apprentices feel pressure to complete five days worth of work in four days, while others note inconsistencies in salaries and workloads. Communication with workplace mentors was identified as an area for growth.

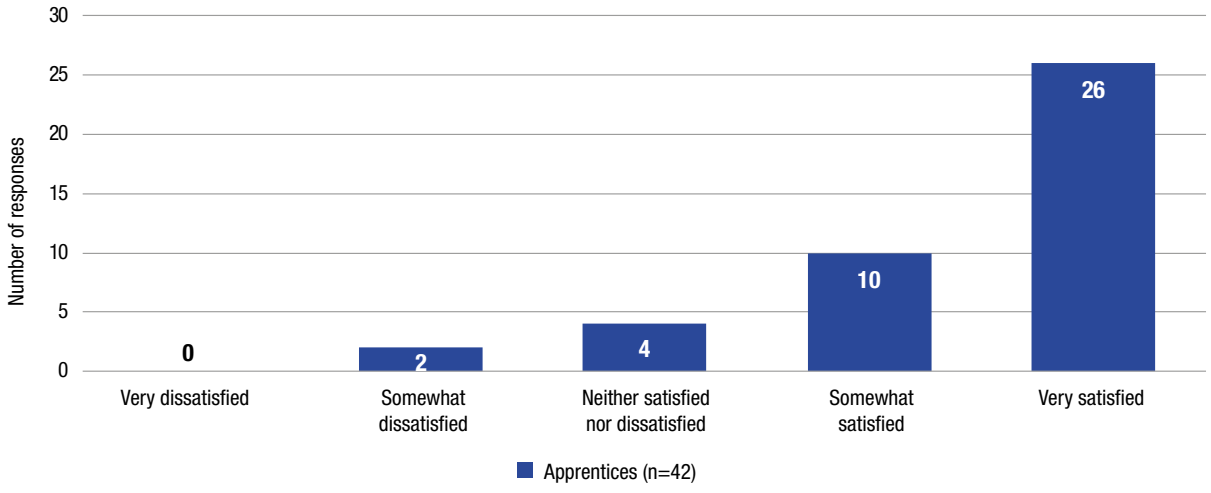
> The main area [for improvement] is the salary. We are expected to work the exact same as other employees and do the exact same work on a four-day work week. There is just as much expected from us as full-time employees which is unrealistic.

Source: Apprentice.

> Employers do not always treat you like an apprentice. My wage reflects the fact that I am an apprentice but nothing else does. I have a lot of responsibilities and a lot of work to get done even though I only work a four-day week and have to complete assignments and exams outside of those hours.

Source: Apprentice.

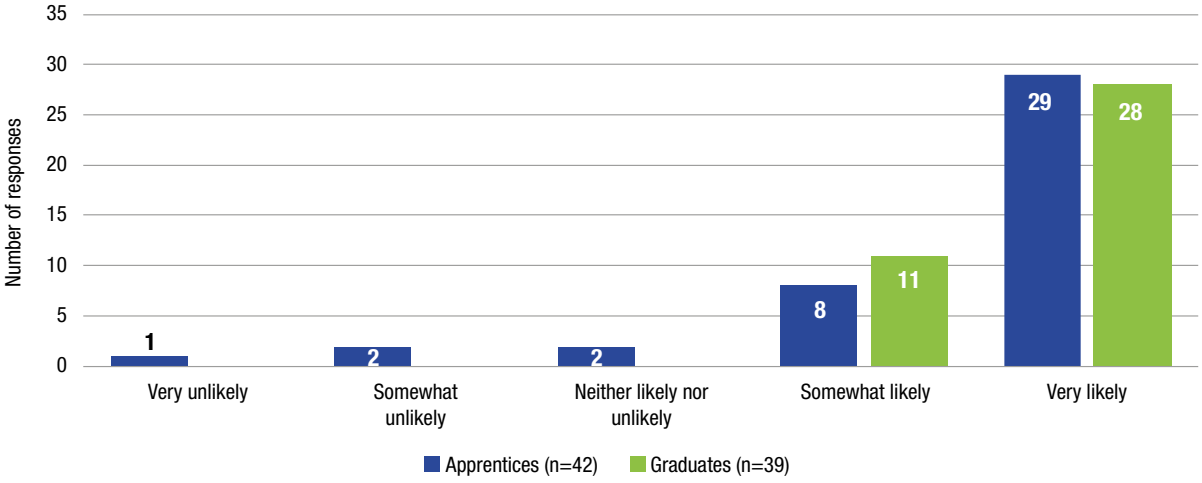
Figure 13. **Apprentices' satisfaction with their decision to enrol (n = 42)**



Source: Authors' calculations.

More than 70 % of graduates are 'very likely' to recommend the degree apprenticeship to a friend. Some graduates suggested that the course be marketed more to school leavers (Figure 14).

Figure 14. **Apprentices' (n = 42) and graduates' (n = 39) likelihood of recommending the course**



Source: Authors' calculations.

2.3.1.3. *Employability*

Most graduates felt that the apprenticeship enhanced their employability compared with other pathways. Most cited the progression and further study opportunities available after graduation, together with skills that support their growth.

> It shows ambition and dedication and gives you an opportunity to progress to level 9 degrees later on, so I think it is good for that reason. I also think I learned a lot from it, I think certain modules like big data, ecommerce and innovation enhanced my skills in the workplace, and although employers do not look for this degree, I think it makes me a better employee than others who did not undertake the programme.
> Some modules developed my confidence in different areas that I would not have had confidence in before such as excel, and again the degree isn't necessary in this industry, but I feel I have stood out in my roles because I have these extra skills that others in my workplace don't have, and I can work more efficiently as a result.

Source: Graduate.

Apprentices are positive about how their employability will be improved through industry experience, professional qualifications and the honours degree. The opportunity to put lecture material into practice in real time is viewed as an advantage. Several respondents felt that the apprenticeship proved their ability to successfully balance work and education commitments.

> The routine of being enrolled in exams and [a] college course has given me the 'bug' for further qualifications and so increasing employability.

Source: Apprentice.

> Having all of the CIP [Certificate in Insurance Practice] exams completed and [an honours] university degree is favourable for employers and the additional three years' experience makes apprentices stand out compared to post grad students who have not worked in the industry yet.

Source: Apprentice.

Others note that the degree allowed them to move to another employment sector.

> Maybe work with the employers that are providing apprentices to have a bit more vision on what comes after the apprenticeship, where can they go, what roles can they take on. I myself left the insurance industry and used my degree to switch to banking because I couldn't see this vision anywhere in Ireland.

Source: Graduate.

2.3.2. **Employer views**

A key enabler of successful apprenticeship is industry engagement. For employers, apprenticeship supports an industry lacking an established talent pipeline. Respondents felt that the apprenticeship offered a defined career pathway that allows the company to plan strategically for the long term.

> The company will have the option to recruit the candidate full time when qualified and they will know the business and need very little training.

Source: Employer.

A key benefit cited is the application of academic knowledge that benefits the company in real time. The blended-learning approach encourages learning among other staff – particularly the workplace mentor, who helps apprentices develop their intrinsic company knowledge. Interestingly, employers feel that the apprenticeship raises the industry profile and is attractive to students. They also note how the apprenticeship reduces onboarding and training costs. The presence and support of the professional consortium is also highly valued. In terms of drawbacks, some noted that the time to complete the apprenticeship (three years) was longer than the time needed to complete just the technical qualifications (two years).

Employers were asked how the apprenticeship has influenced their talent strategy (Table 11). There was near-universal agreement (97 %) that professionally relevant programmes are important for the development of the insurance industry, including for their own company's talent strategy (75 % at least agreed).

Table 11. **Employer sentiment regarding the insurance practitioner apprenticeship (n = 36)**

	Number of respondents				
	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
The insurance apprenticeship is important for my company's talent strategy	9	18	6	2	1
The insurance apprenticeship is important to attract new talent	12	20	2	2	0
The insurance apprenticeship is important to retain talent	8	11	12	3	2
Apprentices who train with the company demonstrate greater loyalty in terms of retention	6	10	9	5	6
Professionally relevant academic programmes are important for the development of the insurance industry	18	17	1	0	0

Source: The authors.

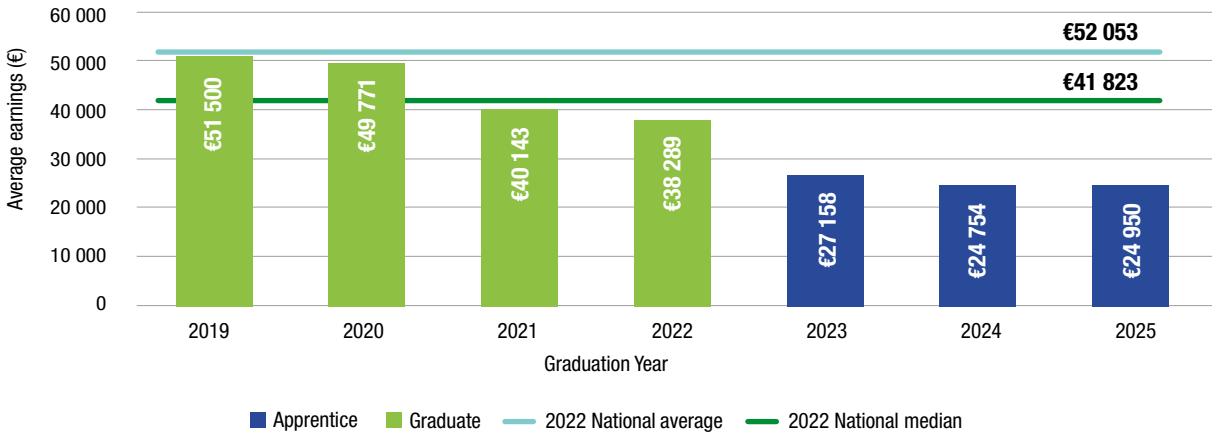
The insurance apprenticeship is intended for early-career professionals. It is unsurprising that a slim majority of employers feel that the apprenticeship is important for retaining talent (53 % at least agree). Finally, only a third of respondents disagree with the idea that apprentices display greater loyalty. Although there are many reasons why employees change employer, responses are probably driven by personal experience.

2.3.3. Graduate outcomes

Another key measure of graduate success is earnings. This section compares self-reported earnings of graduates and apprentices with nationally representative values for the entire labour force and for relevant college graduates by education field and employment sector.

Figure 15 presents average self-reported earnings, split by graduation year, showing that more experienced employees report higher earnings. The first important comparison is between graduate and apprenticeship earnings and national average wages. At the time of the survey (November 2022), national average and median wages were EUR 52 053 and EUR 41 823, respectively (CSO, 2024). Survey-reported earnings three years after graduation (2019 cohort) are comparable to the national average wage. More strikingly, a graduate with one year of experience (2021 cohort) earns approximately the national median wage – exceeding half of workers in the country.

Figure 15. **Average apprentice (n = 42) and graduate (n = 37) earnings**



Source: Authors' calculations using survey data.

Another relevant comparison is with college graduates (Table 12). Insurance practitioner graduates perform well based on (a) their field of study and (b) their field of employment. The latest available national graduate outcomes survey (for 2021) features a 50 % response rate from 72 148 graduates surveyed nine months after graduation (HEA, 2022). That survey revealed that the apprenticeship graduate average (EUR 40 143, n = 19) is higher than the average of all graduates surveyed by the Higher Education Authority, higher than the average for all graduates in the fields of business, law and administration and also higher than the average for the financial, insurance and real estate sector of employment. The insurance practitioner apprenticeship places graduates on a strong footing relative to comparators, implying that the qualification and graduates are highly desired and compensated accordingly.

Table 12. **Comparison of average graduate earnings**

	Average earnings (EUR)
Insurance practitioner graduates (2021 cohort)	40 143
Higher Education Authority graduate survey average value	
All graduates	38 044
(a) Field of study – business, law and administration	
All graduates	37 066
All those with an undergraduate degree	32 409
All those with a postgraduate degree	42 571
(b) Sector of employment – financial, insurance and real estate	
All those with an undergraduate degree	31 560
All those with a postgraduate degree	40 171

Source: Authors' calculations using self-reported data compared with nationally representative values from HEA (2022).

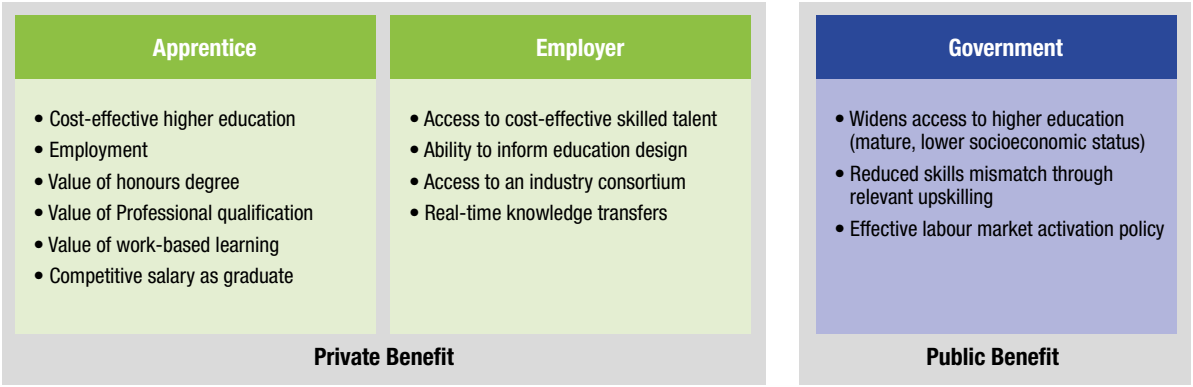
2.4. Conclusions

This research seeks to understand the effectiveness of Ireland's first non-traditional degree apprenticeship model from key stakeholder perspectives. It studies this model as implemented within the financial services sector. It is an important case study due to the critical role of apprenticeship in the modern economy and ambitious national targets for non-traditional apprenticeship expansion (DFHERIS, 2021).

The results suggest that the degree apprenticeship model offers significant benefit to all stakeholders – graduates, employers and current apprentices. These findings, which to the best of the authors' knowledge are novel for the Irish market, are consistent with international evidence. Policymakers should seek to promote apprenticeship as a modern higher education pathway to maximise the public and private benefits available. Additionally, this work underlines the importance of collecting data and surveying apprentices and graduates to gain detailed perspectives on best practices in apprenticeship provision from the most important stakeholder – the end user.

Figure 16 and the following subsections summarise key enablers of success based on the evidence presented in this paper from primary and secondary sources. This serves as a practical resource for stakeholders considering implementing the apprenticeship delivery model in other non-traditional fields. It distinguishes between the private benefits that accrue to apprentices, graduates and employers and the public benefits that accrue to government and wider society.

Figure 16. **Summary of success factors**



Source: The authors.

2.4.1. Private benefit

For employers and students, apprenticeship supports better education and employment outcomes and builds expertise. For students, degree apprenticeship represents a cost-effective higher education pathway and a stepping stone to a career and future learning (Crawford-Lee & Wall, 2018). The ability to earn is an important component of the model, as is the valuable workplace learning.

Graduates and apprentices greatly value the honours degree award. It is a formal transferable qualification that supports their professional development within the modern working world. This is consistent with international literature (Crawford-Lee 2020; Engeli & Turner 2019).

For employers, support through the consortium model is key to the formation and continued relevance of apprenticeship, especially in a regulated sector. Evidence suggests that apprenticeship is a talent pipeline clearly embedded within the talent strategy of firms that brings cost efficiencies. Employers greatly value the real-time knowledge transfers from apprentices to their colleagues (Antcliff et al., 2016; Quew-Jones, 2022). A valuable element of the degree apprenticeship is work-based learning, which is highlighted by employers in this study and in existing research (Boud & Solomon 2001; Cooper et al., 2010).

2.4.2. Public benefit

The results suggest that the degree apprenticeship model improves access to higher education for mature students and fosters diversity and accessibility. This is consistent with evidence elsewhere that suggests that degree apprenticeships improve participation, access and social inclusion (Bradley et al., 2019; Engeli & Turner, 2019; WECD, 2019). Findings suggest that an effective degree apprenticeship can reduce skills mismatch, with government serving as the matchmaker to connect employers with employees possessing relevant skills to make an instant impact. This is particularly important for an economy such as Ireland's, which is facing a tight labour market (EURES, 2023).

The comparison of graduate earnings suggests that the degree apprenticeship model can provide substantial earning potential, which would translate to greater tax revenue earned through higher-paying jobs. Although differences by sector are expected, the results suggest that insurance practitioner graduates earn more in their early employment than similar undergraduate graduates in the financial services sector. This provides a basis to encourage the expansion of modern apprenticeships into other sectors, where appropriate.

2.4.3. Future research

There are several interesting avenues for future research. At the national level, further research to explore the diversity of apprentice experience would help to inform national discourse around progression, reten-

tion and apprenticeship design. A longitudinal study of apprentice outcomes would provide insight into long-term labour market performance, particularly in the light of inflation and economic trends. Future research could leverage available international data to compare the hallmarks of modern apprenticeship to identify best practice. In the same way as formal education standards are aligned with a common framework, a common model of apprenticeship could foster greater opportunity for students to work and study abroad and for more employers to engage.

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CHAPTER 3.

New opportunities through computing degree apprenticeships in Scotland

By Ella Taylor-Smith ([6]), Sally Smith and Khristin Fabian ([7])

3.1. Introduction

Degree apprenticeships in Scotland are higher education apprenticeships with integrated work-based learning, leading to degrees equivalent to traditional, on-campus programmes. The apprentices are recruited by their employer and employed and paid throughout the course. They are required to spend 20 % of their time in study outside their workplace, for example spending one day a week on campus (or online) or undertaking regular blocks of study through the year. The apprenticeship takes about as long as a traditional degree (four years in Scotland), although the academic year tends to be longer for apprentices, for example running through the summer. Academic credits are gained for agreed work-based learning. There are various governance and financial differences in the regulation and implementation of degree apprenticeships across the four UK nations. Parkinson and Dziallas (2024) provide a useful overview of the differences between English and Scottish implementation. Notably, in Scotland degree apprenticeships are currently governed by the Scottish Funding Council and called graduate apprenticeships (OECD, 2022); they were governed by Skills Development Scotland until 2022. To avoid confusion with postgraduate study, we will refer to these (mostly) undergraduate degrees as degree apprenticeships in this paper.

There are four agreed undergraduate frameworks for computing in Scotland: BEng cybersecurity, BSc data science, BSc information technology for business management and BSc software development (SDS & SFC, 2022). These are all honours degrees that include an applied research project in the apprentices' final year. Apprentices studying these degrees are the primary focus of the research described below.

Rather than present one research study in detail, this paper brings together our research on degree apprenticeships, since 2017, using the timeline of the apprenticeship as an organising device (Figure 17). The investigations mostly explore the apprentices' perspective. We start at the beginning of the apprenticeship, looking back at the apprentices' previous education, their recruitment and their routes in. As they begin their studies, we explore their motivations for choosing this path and any apprehensions they have about the years ahead. In their first and second years, we explore the advantages and challenges of combining work and study, while their final year provides an opportunity to focus on their applied (honours) project and to look back. We also begin to investigate the experience of the people who are crucial in the apprentices' journey, including their workplace mentors and university tripartite representatives. Finally, we anticipate the results of an investigation into the outcomes of the apprenticeship from the graduates' perspective. As this account brings together our research on this topic, we apologise for the preponderance of references to our own publications.

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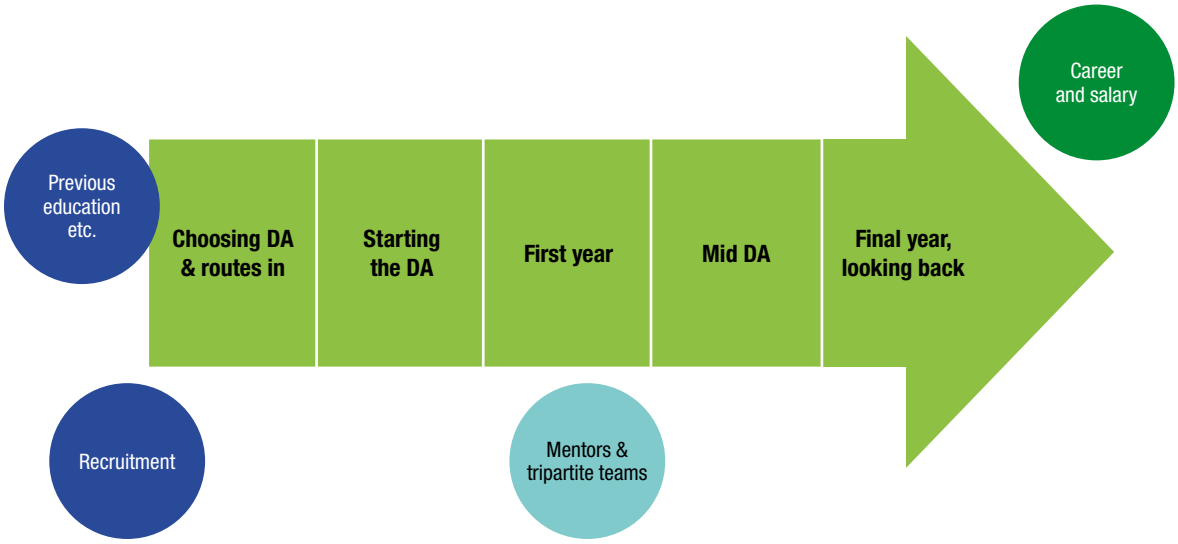
Figure 17. **Timeline of degree apprenticeship studies**



NB: DA, degree apprenticeship.

Source: The authors.

3.2. Routes into the degree apprenticeship: prior experience and motivations

New apprentices were surveyed at induction, on paper at first and online in later years (Smith et al., 2018, 2020a, 2020b, 2021, 2023a; Taylor-Smith et al., 2019a). First-year apprentices were interviewed about six months into their studies, in person at first, then online during the COVID-19 pandemic (Smith et al., 2020a; Smith et al., 2023b; Taylor-Smith et al., 2019b). The surveys and interviews investigated apprentice trajectories into the degree, including their prior education and work experience, and their motivations for choosing this route.

Most apprentices were already employed (e.g. 63 % in Smith et al., 2021; 81 % in SDS & SFC, 2022). This opportunity enabled them to keep their job while they improved their qualifications and skills. For those who were not already in employment, the apprenticeship provided an opportunity for a degree without debt. It was particularly useful for mature learners, who had financial responsibilities such as families and who had left school before access to higher education was widened. As the entrance requirements did not specify computing qualifications, this was an opportunity for a new career in a well-paid, high-demand sector. Gaining work experience was a motivation beyond salary, both as a career advantage and as an interesting way to learn.

Introducing a recurring theme in the research, the apprentices had reached the apprenticeship through a great diversity of routes: a patchwork of further education, higher education (including dropping out of traditional degrees or graduating in a different subject) and previous apprenticeships (including the Scottish modern apprenticeships pathway (SDS, n.d.)). The degree apprenticeship also includes options for advanced entry, with appropriate qualifications or experience, although this was not possible for the early cohorts. Apprentices who were established in employment and using the apprenticeship to upskill had mostly joined their employers with existing subdegree qualifications (such as a modern apprenticeship or higher national diploma), although some had moved gradually into their positions from related roles and some had previous degrees. The convoluted career paths often demonstrated the unsuitability of a careers system that expects young people to make career decisions while still at school and to embark on the challenges of university life as young as 17 or 18. For many, the appren-

ticeship provided a second chance.

Taking a critical look at who was accessing apprenticeships, Smith et al. (2020b) focused on gender imbalance in computing apprenticeships in Scotland, revealing that women represented 28 % of respondents, whereas the equivalent for on-campus computing students was under 20 % in that year. Women were more likely to join the apprenticeship later in life, as career changers into technology were supported by the entrance requirements and mature learners were supported by finance (Smith et al., 2023a). This pattern reflects Corneliussen's (2024) work on women's diverse routes into information and communications technology in Norway. Across the computing degree apprenticeships in Scotland, SDS and SFC (2022) state that the average female representation is 27 %. Across all the frameworks, most apprentices were over 25 years old (SDS & SFC, 2022).

One of the stated aims of the degree apprenticeship was to increase social mobility (QAA, 2019). While apprentices across all age groups came from a variety of socioeconomic backgrounds, many of the upskillers specifically were from less advantaged backgrounds and benefited from a 'belated opportunity for degree-level study' (Smith et al., 2021, p. 488). Less socioeconomic diversity was found among those recruited directly into their apprenticeship, who were disproportionally from more privileged groups. Lester (2020) identifies the need to promote degree apprenticeships specifically to 'potential learners who may not have considered higher education or professional careers' (Lester, 2020, p. 711). While employers rather than universities recruit degree apprentices, universities still have a role in widening access, promotion and outreach.

3.2.1. Recruitment

To begin to investigate the employers' perspective and gain a deeper understanding of the experience of apprentices who applied in response to a recruitment advert, job adverts for computing apprenticeships in Scotland and England were collected over 12 months and subjected to content analysis (Fabian et al., 2023). This study revealed a huge salary range across comparable roles, a lack of information about what the job would entail and a lack of information about alternative entry qualifications. Curiously, the employers seemed to be looking for the same skills in new apprentices that they had previously requested in graduates (e.g. Shadbolt 2016). One impact of this study was to inspire changes to the template given to employers in Scotland for apprenticeship recruitment adverts.

3.2.2. Starting apprenticeship: goals and apprehensions

As noted above, new computing apprentices were surveyed at their university induction day (Smith et al., 2018, 2020a, 2020b, 2021, 2023a; Taylor-Smith et al., 2019a). They also, in teams, drew rich pictures (Parrott, 2019) about their goals and apprehensions as they looked ahead, with each team presenting their picture to the whole room. In the first two years, these pictures were analysed and the presentations recorded, with consent, as research data (Smith et al., 2018; Taylor-Smith & Meharg, 2019). A mirror study was also conducted with on-campus students, including the survey and rich picture session (Smith et al., 2018).

The apprentices' and students' pictures tended to use the metaphors of a hazardous journey or game; the reward at the end was mostly depicted in terms of financial wealth and graduation ceremonies. The apprentices' presentations and the survey responses described their goals in terms of advancing their careers and improving their financial situation: gaining well-paid jobs on graduation. Their worries centred on the time balance of working and studying at the same time, represented by clocks, balance scales and cups of coffee in their pictures. There were also worries about academic study, especially among apprentices who had been out for education for a while. The perspectives of the on-campus students were similar, although they also expressed worries about money and debt, reminding us that the degree apprenticeship model brings a radical opportunity for higher education without student debt (Fabian et al., 2023; QAA, 2019; Smith et al., 2020a).

3.2.3. First year

We interviewed computing apprentices (who volunteered) in their second trimester, about six months into their programme, with the aim of gaining an in-depth understanding of their experiences (Smith et al., 2020a, 2021, 2023b; Taylor-Smith et al., 2019a; Taylor-Smith et al., 2023). For this summary, we highlight findings around identity and work–life–study balance. For most, their work provided a stronger identity than their studies, with their job bringing self-confidence, especially to younger apprentices. They saw themselves as distinct from on-campus students, who they stereotyped as less serious and more leisure-oriented. With one day a week together on campus, a challenging schedule and a perceived difference from the other students, they banded together as a cohort, creating a supportive community.

While working and studying together towards a degree was perceived as a win–win situation financially and in terms of gaining skills, it was a challenge in terms of balancing work, study and the rest of their lives. Apprentices in roles that were less pressured and had regular downtime fared better, as they could find some time for study during their working days. Other apprentices benefited from supportive work colleagues, who took the time to help them, for example by going through elements of coding with them. Meanwhile, apprentices with a lot of responsibility at work needed to do all their studying in their spare time, including evenings, weekends and sometimes holidays, often relying on their partners to cover their responsibilities at home. It became increasingly clear that the different contexts of the apprentices, especially in terms of their age and level of responsibility, had a big impact on how they experienced the apprenticeship. Stone and Worsley (2022) provide a parallel account of social work apprentices' strategies to manage full-time work and study, with negative impacts on family time.

3.2.4. Mid apprenticeship

The insights from the interviews, combined with our ongoing literature review on work-based learning, were distilled into inputs for a Q-sort (Fabian et al., 2022; Johnston et al., 2003). Second-year apprentices were invited to sort cards containing statements about apprentices' experiences, for example 'The things learned at work are useful for coursework.' The apprentices were required to sort the cards, according to agreement and importance, in a specially shaped Q-sort grid. The resulting grids were then analysed via factor analysis to identify groups with similar responses, reflecting similar experiences of the apprenticeship. We identified three groups, which we described as personas:

(a) the aligned student worker – enjoys both working and studying; is generally new to their work role; has some downtime included in their work, during which they can catch up on their studies;
(b) the busy professional – already has a position of responsibility at work, so it is a challenge to fit in their studies;
(c) the cast adrift apprentice – lacks support in the workplace, for example they have not been allocated a mentor or opportunities to discuss career development.

These personas (fictional characters designed to hold abstracted and anonymised characteristics; see Huynh et al., 2021) are used as part of the training for workplace mentors.

3.2.5. All years: COVID-19 lockdown

Apprentices studying computing, engineering or early years education, in two Scottish universities, were invited to complete a reflective, iterative, online survey about their experience of working and studying during the COVID-19 lockdown periods (Taylor-Smith & Fabian, 2021). While the survey was prompted by an unusual situation, its findings highlight characteristics of the degree apprenticeships evident in our other research, for example how three domains of life seemed to compete for the apprentices' time: work, family and study. The apprentices had very different experiences of the pandemic according to whether they were working from home or on-site, whether the pandemic caused an increase or decrease in their workload and whether they had caring responsibilities, such as for young children.

3.2.6. **Final-year apprentices' reflections**

We interviewed apprentices in their final year who were studying computing or business. During these interviews, apprentices were encouraged to look back over the four years of their course and focus on their current, credit-bearing, applied project. For the computing apprentices, we were able to pair 13 final-year interviews with each apprentice's first-year interview to conduct a longitudinal analysis (Taylor-Smith et al., 2023). Across the full set of final-year interviews, we conducted a framework analysis, drawing on conservation of resources theory in order to explore stress and wellbeing (Hobfoll, 1989; Taylor-Smith et al., 2023).

Summarising the analyses together, we found the integration of work and study to be important to apprentices in terms of having increased satisfaction and a decreased programme workload (Garnett & Reynier, 2025). Workplace mentors could play a key role in facilitating this. We identified gains for the employer in terms of the apprentice bringing new skills into their organisation; for example, some of the applied projects became functioning applications and useful elements of the business. One apprentice described choosing their project with their mentor: 'They were pretty confident that that's what I should do, because it had a huge client benefit as well' (Taylor-Smith et al., 2023, p. 3). Garnett and Reynier (2025) found that the work-based projects in degree apprenticeships had the potential to increase productivity throughout the organisation. Interviewees also described how they gained new friends through the cohort, in addition to skills and knowledge. In terms of the longitudinal analysis, we found that apprentices were likely to take on more responsibility and gain more agency over their work as the apprenticeship progressed, which was reflected in promotion but also increased the challenges of work–life balance and finding time to study.

3.2.7. **All years: workplace mentors**

Prompted by our findings around the importance of workplace mentors, we investigated the training universities provided , across computing programmes in Scotland. This involved an online survey of workplace mentors and the university staff who supported them, a review of training guides and handbooks, and an activity theory analysis (Taylor-Smith & Smith, 2024). The study revealed a lack of training provided to workplace mentors, with few mentors aware of available training and most training provided only at induction. Opportunities for mentors to learn from each other (or from apprentices and graduates of the programme) were missing. Most of the mentors were self-trained through experience but remained enthusiastic. The project led to the creation of training resources to start to fill the gaps; these include an animation and an infographic, and have a special focus on mentoring for inclusion.

3.3. Current research

We are analysing data from a survey of graduates from computing and engineering degree apprenticeships to assess the impact of the programmes on social mobility. We are also beginning an investigation into the role of university staff who support the apprentices, through tripartite meetings with the apprentices and their workplace mentors. This comparison across the four UK nations uses case studies and rich pictures to explore how the role of university staff is implemented and experienced across different disciplinary and policy contexts.

3.4. Conclusions and policy implications

Computing degree apprenticeships provide good opportunities for school leavers, career changers and upskillers, especially as they may not need previous computing qualifications. Apprentices reported that they quickly became useful employees, for example as software testers, and benefited from gaining

new skills, even when their career was already well established. The apprentices have a wide diversity of contexts, especially due to differences in work status and responsibilities. More opportunities for training and sharing expertise between the staff who support them, such as workplace mentors, would be beneficial.

For degree apprenticeships in general, it is clear that the combination of working and studying at degree level is hard work, which requires apprentices to invest significant leisure and/or family time to study. There is currently a lack of awareness of the opportunities offered by the degree apprenticeship: the apprenticeship and degree combination is not well known and some apprentices have status worries about how their qualification will be regarded.

While degree apprenticeships are still a relatively new model in the United Kingdom, they need to be supported, but also investigated, in terms of their implementation and impact. There are clearly paths to innovation, which could be useful across higher education (Power-Mason et al., 2025; Saville et al., 2020), but the diversity of the apprentices' contexts may be a challenge for expansion, and this is unlikely to be remedied by further administrative burdens.

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CHAPTER 4.

The IT Apprenticeship Programme for Indigenous People: a model for reconciliation and digital inclusion in Canada's public sector

By Faun Rice ([8]), Valerie Thomas ([9]) and Julie Lalonde ([10])

4.1. Introduction

Apprenticeships typically involve structured vocational preparation, employer supervision and a blend of work experience and part-time education (Smith et al., 2019, p. 128). They generally lead to nationally recognised qualifications and are often regulated by a professional body (Cedefop, 2024; OECD, 2018). Apprenticeships have long been a cornerstone of vocational education and training, which provides learners with the skills and knowledge required for a particular occupation (Eurostat, 2021).

In Canada, apprenticeships are considered one of several types of work-integrated learning (WIL) (CEWIL Canada, 2024). However, they are distinguished from other types of WIL by their greater length (two or more years) and, for some organisations, the supervision of an apprentice by a certified journeyperson (CEWIL Canada, 2024). Apprenticeship models such as the federally regulated Red Seal Program, which sets interjurisdictional occupational standards, have been traditionally applied to occupations such as skilled trades (Red Seal Program, 2024). Other long-standing WIL programmes in professions such as law, education and healthcare in Canada meet international definitions of apprenticeship programmes (Cedefop, 2024; OECD, 2018); for example, a legal articling student is mentored through a work placement between their degree and studying for admission to a provincial Law Society (these societies govern Canada's legal profession) (Government of British Columbia, 2024). However, student work placements in these professions are not typically called apprenticeships in Canada, partly due to their relatively short length.

Beyond skilled trades and health, education and law professions, recent scholarship and practice has indicated that apprenticeship models might be appropriate tools to deliver digital skills training, including in information and communications technology (ICT) occupations (Cedefop & OECD, 2024). In Canada, ICT WIL is viewed as a foundational part of training for science and technology occupations due to fast-changing employer requirements and required skills and tools (Cutean et al., 2023). Beginning with the University of Waterloo in 1957, Canadian post-secondary educational organisations have long used cooperative education (set apart from other types of WIL by featuring alternating work–study terms) to build transferable and technical skills among students such as those training to be engineers (Haddara & Skanes, 2007; Jones & Quick, 2007). In cooperative education, employers enable students pursuing a degree to gain up-to-date digital skills.

Building a programme with all the features of an apprenticeship for the ICT sector poses challenges different from those in ICT cooperative education, however. About 80 % of an apprenticeship consists

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of long-term, paid work experience, while 20 % is training (CEWIL Canada, 2024). Given the length of an apprenticeship and the pace of technological change, ICT curricula may be subject to continuous renewal. Furthermore, unlike for professions and trades, there is no single, national professional organisation that governs ICT occupations in Canada. Nevertheless, the apprenticeship model shows significant promise for developing talent in this sector (Cedefop & OECD, 2024).

This case study examines a Canadian apprenticeship programme for information technology (IT) occupations, including a brief history of its impetus and goals, and early data on outcomes. The IT apprenticeship programme for Indigenous peoples (hereinafter 'the programme') has several novel characteristics that make it an instructive case. The programme is specifically for First Nations, Inuit and Métis peoples, who are collectively referred to as Indigenous peoples but reflect a diverse array of nations, communities and cultures of the first peoples of North America (Government of Canada, 2024a).

The programme was designed by, for and with Indigenous peoples to address systemic barriers to employment in the public service faced by Indigenous peoples by downplaying formal educational requirements and focusing on an individual's passion, potential, lived experience and interest in IT. In addition, the programme aims to increase the representation of First Nations, Inuit and Métis peoples in the federal public service IT workforce, to include Indigenous perspectives in shaping government of Canada digital services and to address skills gaps and digital workforce shortages. Finally, the programme aims to take concrete actions to advance reconciliation with Indigenous peoples in Canada and pave the way for a more diverse and inclusive IT workforce in the government of Canada.

4.2. Programme design and implementation

4.2.1. A brief history of the government of Canada IT Apprenticeship Programme for Indigenous People

The programme was launched in 2020 by Employment and Social Development Canada (ESDC) ([11]) as a small pilot initiative. The two-year full-time developmental programme hires apprentices into an entry-level IT role with a standard salary for that position, within the federal public service. Apprentices have an 80:20 work-to-learning schedule: 80 % of the apprenticeship is dedicated to WIL with a peer partner and 20 % is dedicated to self-paced learning, following a curated curriculum. Successful completion of the apprenticeship fulfils the alternative educational requirement of the IT minimum qualification standard of the government of Canada (i.e. it is an acceptable alternative to graduation from a two-year IT-related programme; Government of Canada, 2023a, 2024d). Thus, successful graduates are deemed to meet the criteria of education, training and/or experience combined.

As discussed in this paper's introduction, the apprenticeship is designed specifically for First Nations, Inuit and Métis Peoples (Canada's three distinct groups of Indigenous peoples). Indigenous peoples make up about 5 % (more than 1.8 million people) of Canada's total population and are the fastest-growing and youngest population in Canada (Government of Canada, 2024a). Yet Indigenous people face systemic barriers to accessing post-secondary education and consequently are largely under-represented in roles that traditionally require university degrees (Statistics Canada, 2023). For example, only 1.4 % of Indigenous employees in Canada are in technology occupations, compared with 4.8 % of non-Indigenous workers (Lockhart & Vu, 2024).

In 2017, an interdepartmental inquiry on the status of Indigenous peoples in the Canadian federal public service resulted in a call to improve inclusion of Indigenous federal public servants (Wilson, 2017). This has also been identified as a key priority for federal ministers through documents such as mandate

([11]) ESDC's mission, which also covers the federal labour programme and Service Canada, is to build a stronger and more inclusive Canada, to support Canadians in helping them live productive and rewarding lives and improving Canadians' quality of life. It fulfils this mission through various policies, programmes and other instruments, as outlined on the department's website.

letters ([12]). In addition, the federal public service has faced some challenges in attracting and retaining ICT talent in terms of competition with the private sector. The programme was created in part to address these challenges. It was also designed to contribute to reconciliation with Indigenous peoples in Canada. Given this, the programme takes concrete actions to contribute to the following international and national calls to action (Box 2).

Box 2. **National and international calls to action informing the creation of the IT Apprenticeship Programme for Indigenous People**

United Nations declaration on the rights of Indigenous peoples (2007)

Article 17(3): 'Indigenous individuals have the right not to be subjected to any discriminatory conditions of labour and, inter alia, employment or salary.'

Article 21(1): 'Indigenous peoples have the right, without discrimination, to the improvement of their economic and social conditions, including, inter alia, in the areas of education, employment, vocational training and retraining, housing, sanitation, health and social security.'

Truth and reconciliation commission of Canada calls to action (2015)

Call to Action 7: 'We call upon the federal government to develop with [Indigenous] groups a joint strategy to eliminate educational and employment gaps between [Indigenous] and non-[Indigenous] Canadians.'

Call to Action 92: 'We call upon the corporate sector in Canada to … ensure that [Indigenous] peoples have equitable access to jobs, training, and education opportunities in the corporate sector, and that [Indigenous] communities gain long-term sustainable benefits from economic development projects.'

Final report of the National Inquiry into Missing and Murdered Indigenous Women and Girls (2019)

Call for Justice 4.4: 'We call upon all governments to provide supports and resources for educational, training, and employment opportunities for all Indigenous women, girls, and 2SLGBTQQIA people. These programs must be available within all Indigenous communities.'

Sources: National Inquiry into Missing and Murdered Indigenous Women and Girls, 2019; Truth and Reconciliation Commission of Canada, 2015; United Nations, 2007.

The pilot programme was successful in increasing the representation of Indigenous people in ESDC's digital workforce and, in 2021, the government of Canada Chief Information Officers Council ([13]) mandated ESDC to expand the initiative as a whole-of-government programme to increase the representation of Indigenous peoples in the government of Canada's digital workforce.

The intended policy outcomes of the programme are that:

(a) Indigenous participants in the programme gain in-demand skills in IT to excel in the digital economy and to participate in critical IT roles;
(b) Indigenous apprentices who successfully complete the programme are fully employed in the digital economy and report improved socioeconomic outcomes (wellbeing, health, housing, social inclusion, etc.) and social determinants of health;
(c) Indigenous representation in the IT sector is increased and the digital economy benefits from the talents and perspectives of Indigenous peoples;
(d) the programme contributes to educational, employment and economic reconciliation with Indigenous peoples in Canada by building a skilled and competitive Indigenous IT (digital) workforce in Canada.

([12]) The 2021 Canadian ministerial mandate letter reads 'I am directing every Minister to implement the United Nations Declaration on the Rights of Indigenous peoples and to work in partnership with Indigenous peoples to advance their rights' (Office of the Prime Minister of Canada, 2021).

([13]) The Chief Information Officers Council is a forum for consultation and discussion on enterprise-wide initiatives relating to the management and delivery of efficient and effective digital services to Canadians and the government of Canada. Engagement with the council informs recommendations to the government's Chief Information Officer on strategies and policies to address opportunities and challenges related to managing digital services within government of Canada organisations.

The programme was designed by ESDC based on a synthesis of three streams of discussion: Indigenous peoples and organisations, the IT sector in Canada and other federal organisations. These three streams of discussion collectively confirmed that the unique characteristics of an apprenticeship model were appropriate for the programme on two fronts. First, discussions with Indigenous peoples and Indigenous-led organisations concluded that apprenticeships align with Indigenous world views of learning, which include experiential learning and independent learning. The programme also incorporated holistic approaches to learning when possible, incorporating space to address intellectual, spiritual, emotional and physical dimensions to foster well-rounded development. Second, discussions with the technology sector suggested that employers highly valued work experience and work-embedded learning, in addition to self-motivated skills development, over classroom-style IT training.

4.2.2. **Designing the programme: engaging with Indigenous-led organisations**

Engagement with Indigenous peoples and organisations informed the accessible and culturally relevant design of the apprenticeship programme. Organisations included the Aboriginal Labour Force Development Circle, the Centre for Aboriginal Human Resource Development, the First Nations Technical Institute, the Native Women's Association of Canada and many other bodies representing Indigenous communities and nations with expertise in how workforce development programmes can best serve Indigenous participants.

Based on this engagement, the programme takes several approaches to improve access to IT work for Indigenous applicants. First, it does not require any post-secondary qualifications; rather, it requires the completion of secondary education or equivalent (General Education Development (GED) / high school diploma) and an interview with a programme representative, to build relationships and assess the applicant's interest in and passion for IT, their curiosity and their commitment to learning. Post-secondary requirements create a barrier for many Indigenous peoples ([14]).

Another approach addresses the potential barrier to IT sector employment of living in an Indigenous community, as the government of Canada workforce is primarily situated in the national capital region (Ottawa and Gatineau) or in large cities. When possible, programme apprentices work remotely to maintain connections within their home communities. The unique circumstances of the COVID-19 pandemic enabled this accessibility measure: for the first time, Canadian public servants were permitted to work remotely. Despite the widespread post-COVID-19 'return to the office' in the Canadian federal public service, efforts have been made to support Indigenous employees of the government of Canada to work from their Indigenous communities, when possible.

The engagement with Indigenous peoples and organisations also helped the programme team design appropriate forms of support for apprentices as they complete their work placement and training. Apprentices have access to mentors, who provide career guidance, and Indigenous success facilitators from the Office of Indigenous Initiatives at ESDC, who offer one-on-one support and guidance. Apprentices are also supported by regular talking/sharing circles. Indigenous peoples of North America have used talking/sharing circles as a method of storytelling, sharing experiences, problem-solving and decision-making since time immemorial, with each community practising a unique variation that is appropriate to their specific culture and traditions. In general, the talking/sharing circle approach is based on equality between participants and provides a respectful and supportive environment whereby Indigenous peoples can autonomously express their perspectives and reflect on their experiences without interruption or questioning in a confidential, safe space. Through actively listening to one perspective at a time, and following the principle of sharing power with each other, solutions to problems are identified and the group achieves a shared understanding that aims to benefit the entire community. When individuals

([14]) The First Nations Information Governance Centre found that 29 % of First Nations men and 33 % of First Nations women had completed post-secondary degrees, compared with the Canadian average of 57 % (FNIGC, 2016). It concludes that programmes promoting high school completion and youth apprenticeships are crucial interventions.

can bravely communicate their point of view without fear of interruption or judgement, a nuanced sense of community is generated (Huguenin, n.d.; Hunt & Young, 2021; Tachine et al., 2016; Winters, n.d.).

Finally, the programme is structured to provide culturally relevant support, which is discussed further in subsequent sections. Through this support, the programme team hopes to achieve positive experiences for apprentices, leading to greater opportunities for long-term employment in federal IT roles, should they wish to pursue a career in the federal public service.

4.2.3. Designing the programme: engagement with the Canadian IT sector and federal government

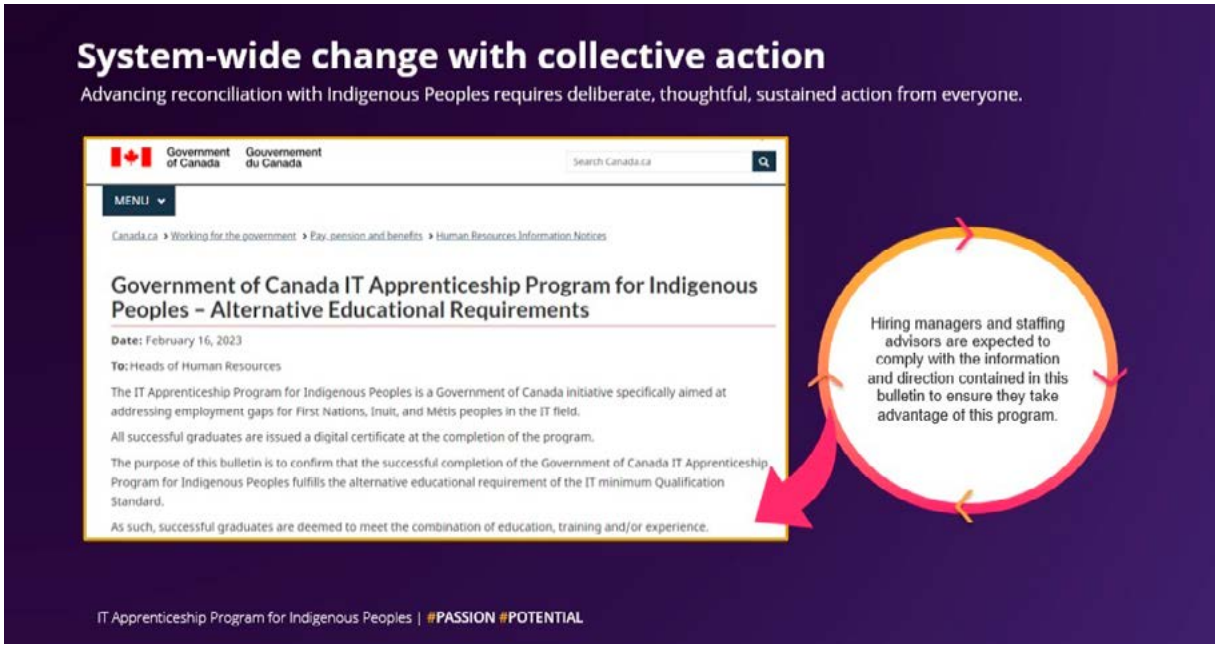
Consultation with the IT sector in Canada was led by the Information and Communications Technology Council (ICTC) on behalf of ESDC. ICTC is a non-profit labour market research and workforce development organisation. ICTC conducted a labour market analysis of private-sector IT occupations in Canada and the degree to which their skill profiles corresponded to those of public-sector IT occupation classifications, in addition to an analysis of in-demand skill sets and certifications for entry-level IT roles.

ICTC also convened a round table of representatives of Canadian employers who (a) jointly conducted substantial entry-level IT hiring and/or (b) had a stated interest in supporting Indigenous peoples through IT hiring, such as those from certified B Corporations. Participants were typically in recruitment, human resources or senior management roles and provided feedback on programme curriculum and implementation, and framing for the final credential. Feedback from the private sector emphasised the importance of soft, human and transferable skills, which were included as part of the curated learning curriculum.

The programme team convened federal organisations, including Shared Services Canada (the federal agency that provides secure and reliable digital, network and hosting services that allow public servants to work collaboratively and seamlessly) and the Treasury Board of Canada Secretariat, in order to identify in-demand IT roles and corresponding skills and competences to design a curriculum that aligns with these public-sector roles. In 2021, the federal Chief Information Officers Council mandated the programme to support apprentices in IT roles across federal departments, not just in the programme home department of ESDC.

Finally, in February 2023, the Treasury Board of Canada Secretariat issued a notice to all federal heads of human resources (Figure 18). The notice directs these staff members to consider the programme credential as equivalent to the alternative education requirement for minimum qualification for public service IT roles: 'graduates are deemed to meet the combination of education, training and/or experience' for an IT-01 role within the government of Canada (Government of Canada, 2023a). IT-01 is the entry-level occupational classification for federal IT professionals and can encompass diverse IT roles in areas such as infrastructure operations, software solutions and IT security (Government of Canada, 2023b). Potential for subsequent advancement in IT occupations within the government of Canada is assessed by an individual's manager.

Figure 18. **Notice to government of Canada heads of human resources on alternative educational requirements**



Source: Government of Canada IT apprenticeship programme for Indigenous peoples, 2024; Government of Canada, 2023a.

4.2.4. Implementation: how the programme works

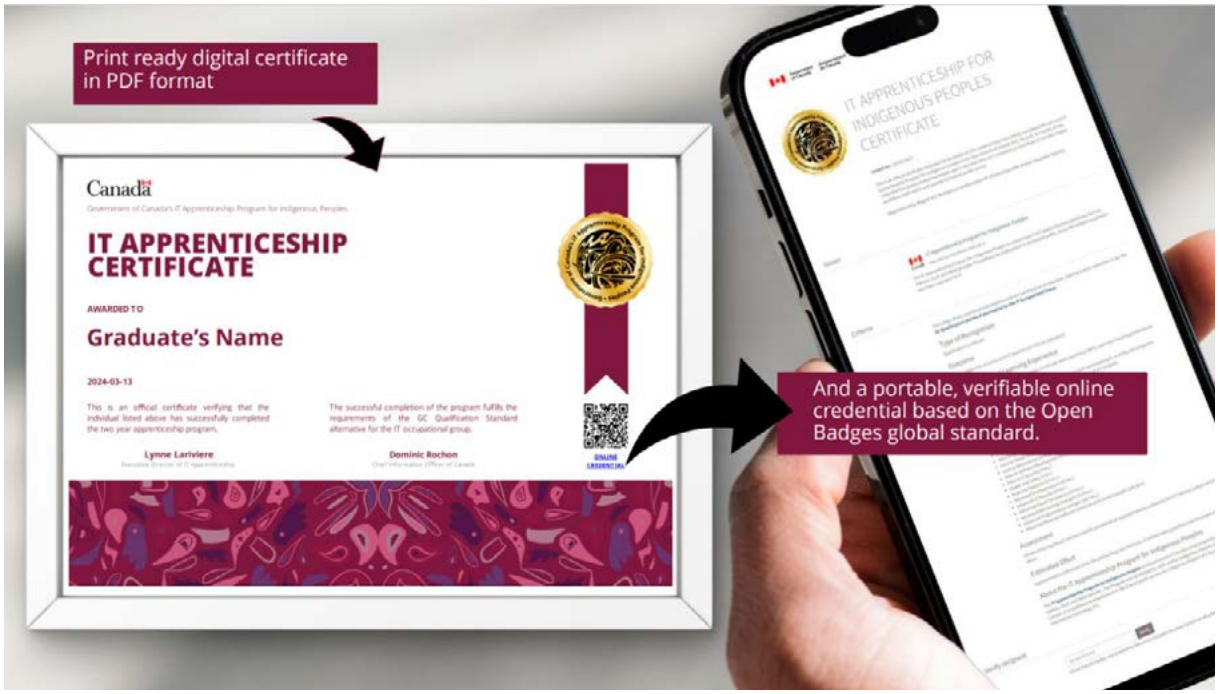
Successful applicants are hired into a 24-month apprenticeship within the government of Canada. Four of five days (30 hours per week) are spent working full time in an IT work placement within a government of Canada organisation. The other day (7.5 hours per week) is spent on self-paced online learning (see Section 4.2.5) to provide foundational training in IT and generate interest in a variety of IT subfields.

Apprentices have access to several mentors associated with their work experience within the department in which they were hired. These can include a supervisor, who provides typical managerial oversight, and a separate team lead, who coordinates departmental activities. Apprentices also have a peer partner, who has IT responsibilities (although partners may hold a variety of job titles) and works on day-to-day tasks with the apprentice within their hiring department. Finally, apprentices have access to success facilitators, designated mentors within the programme staff who liaise with organisations across the government of Canada to make sure the programme is delivered in a standardised manner, offering support to both apprentices and host organisations.

Generally, the programme accepts applications for a continuous intake of Indigenous individuals across Canada. The programme then arranges work placements between qualifying participants and hiring organisations to initiate the apprenticeship. In 2024, federal partners and the programme team began experimenting with a cohort approach, in addition to a rolling start date, to instil a sense of community among apprentices. Another emerging approach has been to pilot rotational assignments for apprentices to build skills and explore various functions in IT. These iterations allow the programme team to better understand all models available and gather developmental evaluation data.

Upon completion of 24 months of work experience and approximately 500 hours of self-paced learning, apprentices graduate from the apprenticeship with a digital certificate and a verifiable credential (see Figure 19) issued by the government of Canada and are formally recognised as fulfilling the alternative to the education requirement for IT-01 positions, which includes a combination of education, training and/or experience. The digital certificates are Open Badges, which comply with the World Wide Web Consortium's recommendations under the verifiable credentials data model v2.0 (W3C, 2024).

Figure 19. **IT apprenticeship programme for Indigenous peoples digital certificate**



Source: Government of Canada IT apprenticeship programme for Indigenous peoples.

4.2.5. Curriculum: self-paced learning across IT topics

As described Section 4.2.3, apprentices who graduate from the programme are deemed to qualify for entry-level roles in areas such as infrastructure operations, software solutions and IT security within the government of Canada. The primary purpose of the 20 % self-paced learning within the apprenticeship is to introduce apprentices to the breadth of potential roles and areas of focus they could pursue. The programme staff includes an IT learning facilitator. The IT learning facilitator is an experienced IT professional who designs curricular learning outcomes, updates course selections to make sure they are up to date and offers support to apprentices who have questions about their training. The curriculum is designed to be evergreen: while it always introduces apprentices to the core topics discussed in this section, specific selections of courses, programming languages and course vendors may vary.

In its current iteration, apprentices begin with a government of Canada 'school of public service essentials' course, offered online through a blend of synchronous and asynchronous self-paced training. This provides an overview of working in the federal public service and introduces apprentices to policies and guidelines related to working in digital occupations.

Subsequent core curriculum introduces foundational IT knowledge, such as IT help desk training for beginners, and the basics of networking, cloud computing concepts and cybersecurity at work. More advanced classes offer Computing Technology Industry Association (CompTIA) certification preparation, the foundations of programming languages, data analysis and visualisation, and cloud app development.

Currently (April 2025), apprentices undertake courses from e-learning providers, including the Canada School of Public Service, LinkedIn Learning and Microsoft Learn; however, the overall learning objectives of the core curriculum are independent of the particular vendor. The core purpose of the self-paced learning is to expose the apprentices to the core types of roles they may take and skills they might need in IT-01 government of Canada occupations, including IT, cybersecurity, software development, cloud computing, networking and data analysis. The programme aims to give apprentices the tools to identify and pursue areas of interest and skill, through self-paced learning time that is reserved for electives, during which apprentices develop a core area of focus within one of the topics discussed. Because the

primary field of study, IT, is constantly evolving, the curriculum is designed to remain evergreen and is refreshed when needed.

If apprentices require support with their self-paced learning, there are several resources available. Their IT learning facilitator is available as a subject matter expert. Apprentices can also seek feedback from peers in their home department, or supervisors. Finally, the apprentice community has a shared Microsoft Teams channel where they can chat and problem-solve as a group.

There are several reasons why learning is currently offered as self-paced, rather than in a classroom style. First, apprentices are working from communities across Canada, a country with six time zones. Self-paced learning creates greater flexibility for learners accessing content from their homes. Second, there are many diverse areas of potential focus for IT professionals within the government of Canada. By offering a core mandatory curriculum and subsequent elective courses, the programme seeks to allow apprentices to acquire the same foundation but build independent focus related to their work placement.

4.3. Programme outcomes

The programme is relatively new: pilot programme participants have just begun to graduate and embark on their IT careers, while new cohorts of apprentices have been onboarded into the programme, which is still undergoing refinement (curricular refinement is discussed in section 4.4). Early outcome data are reported here, including progress towards programme policy objectives. However, a full impact assessment and evaluation is expected in years to come.

4.3.1. Programme outcome data to date

At the time of writing (30 April 2025), the programme has hired 197 Indigenous apprentices, with a 95 % programme retention rate. In addition, the programme has early evidence of strong performance in several areas of interest, including recruitment, gender equity and employment (Box 3).

With over four years of data now in place, the programme team has taken significant steps to meet its policy objectives. First, minimal attrition, enabled by the programme's intentional support structure, has helped ensure that apprentices remain in the programme long enough to gain significant and meaningful IT experience. Most programme graduates have secured indeterminate employment or are in the process of securing longer-term employment in the government of Canada's digital workforce. The impact of the programme on the private sector is yet to be assessed: if graduates choose to transition out of the government of Canada at a later stage in their career, their pathways will be instructive and further inform programme development. The programme team has also learned, anecdotally and through surveys, that some apprentices have experienced improved socioeconomic outcomes as a result of the programme, such as improved access to housing or the ability to work remotely from their home community, therefore spending more time with their family and community.

Box 3. **IT Apprenticeship Programme for Indigenous People: impact as of 30 April 2025**

Employment equity and Indigenous inclusion. A total of 197 Indigenous peoples have been hired through the programme, representing 27 % of the 734 individuals who identify as Indigenous peoples working in the government of Canada's IT workforce (out of 20 696 individuals in this workforce overall, as of 31 March 2024).

Successful graduates and stable long-term employment. Forty-six apprentices have successfully graduated from the programme. Most graduates have been hired indeterminately in the government of Canada or are in the process of securing longer-term employment.

Gender diversity. Sixty-two (31 %) of those hired through the programme identify as Indigenous women or gender diverse, 8.3 percentage points more than the latest reported number of women working in IT in the government of Canada (22.7 %).

Supporting communities. Forty-two (21 %) of those hired through the programme are working from or living in an Indigenous community, representing a financial injection of close to CAD 2.8 million into local Indigenous economies.
Interest from across the country. A total of 1 071 applications were received from over 325 Indigenous communities and nations located in every province and territory in Canada.
Structural change. The programme has outperformed historical Indigenous IT recruitment and retention efforts in the government of Canada by removing barriers to employment, reaching an unprecedented 95 % retention rate.

Sources: Government of Canada IT apprenticeship programme for Indigenous peoples, Employment and Social Development Canada.

Additional early evidence of the programme meeting its policy objectives comes from increased representation of Indigenous peoples in the IT sector and in the government of Canada. The federal public service is one of the largest employers in Canada: in 2024, it employed over 360 000 personnel, or nearly 1 in every 1 000 people living in Canada (Government of Canada, 2024c). Since 2020, the programme has helped increase the number of Indigenous peoples working in the federal government's digital workforce by 197, which amounts to 27 % of the 734 employees in IT who identified as Indigenous peoples, as of 31 March 2024 (Government of Canada, 2024b). By increasing the number of Indigenous peoples in the government of Canada's digital workforce, the programme hopes to create a context in which the design of digital services will be more inclusive and reflective of the population.

4.4. Discussion

As discussed in this paper's introduction, applying apprenticeship models to the IT sector invokes several unique considerations: for one, IT sector tools, technologies and associated skills (e.g. programming languages) shift in demand frequently. On the one hand, apprenticeship models in IT are particularly appropriate because employers might be best placed to keep track of rapid changes in skills, tools and technologies. On the other hand, it can be challenging to design a curriculum without it requiring frequent revision and associated approvals. For example, during the IT private-sector engagement that informed the programme's initial design, the industry recommended focusing on transferable skills and abilities, such as communication, the ability to learn and independence, because knowledge of particular tools or programming languages would change too rapidly for technical skills training to keep up.

This paper has emphasised an evergreen curriculum and adaptability as one response to the challenge of designing technical skills training. Vendor-neutral design allows the programme's IT learning facilitator to select courses based on the most up-to-date content. In addition, the programme collects regular feedback from apprentices and hiring managers through questionnaires/surveys to inform adaptation to evolving needs. Recent feedback has identified that apprentices would benefit from more opportunities to practise what they have learned, to learn through facilitated rather than asynchronous coursework and to earn additional industry-recognised certifications. While several programme elements already seek to address these needs (e.g. the IT learning facilitator role, the opportunity to practise skills through WIL), the programme team is working towards improving the learner experience by incorporating courses that offer skill assessments, sandboxes, labs, facilitated training, certifications and other ways to confirm knowledge retention and practical learning.

Another opportunity that has recently arisen for the programme is access to IT training procured for all government of Canada IT employees through their union, the Professional Institute of the Public Service of Canada (PIPSC). The PIPSC announced funding, in 2024, for learning opportunities for government of Canada staff to deepen IT skills, including funding for online self-paced learning, instructor-led courses and certification exam vouchers. The programme team is exploring aligning its core and elective courses with PIPSC-offered training to enhance access to instructor-led courses for apprentices who prefer that style and schedule of learning. An opt-in approach helps mitigate the potential issues of such training:

that apprentices may be working from any of Canada's six time zones, making classroom-facilitated learning a logistical challenge, and that potential areas of focus within IT are diverse.

While the programme has achieved early success, primarily due to its deliberate emphasis on providing culturally relevant support to apprentices and committing to the importance of developing positive relationships, additional design considerations would need to be factored in if it was to broaden its scope and scale outside the federal public service. Given the success of the apprenticeship programme in accomplishing its policy objectives, similar models are already being developed in other occupational groups in which Indigenous peoples are under-represented and in which there is a skills gap. Inspired by the IT apprenticeship programme, the Indigenous financial management apprenticeship programme is co-led by the Aboriginal Financial Officers Association of Canada and the government of Canada. It offers a 24-month apprenticeship split between work experience in a federal financial services role and studying as part of the association's Indigenous Financial Management Certificate programme, offered in partnership with Simon Fraser University in British Columbia, Canada (AFOA Canada, n.d.).

4.5. Conclusion

The IT apprenticeship programme for Indigenous peoples offers a unique case study on the challenges and opportunities of adapting apprenticeship models to new sectors such as IT and for underserved and equity-deserving groups, in the context of the policy goals of the Canadian federal public service, namely economic reconciliation and representation of Indigenous peoples. The programme demonstrates how apprenticeships can be successfully implemented in rapidly evolving sectors such as IT, which require flexible and responsive training approaches. The evergreen curriculum model adopted here, where course content can be continuously updated, offers a potential solution for other countries or regions grappling with similar challenges. Additionally, the programme's lack of post-secondary degree requirements is an important innovation in making IT roles more accessible to equity-deserving groups, such as Indigenous peoples in Canada, without sacrificing the quality of training.

The programme's design, which was informed by extensive consultation with private-sector employers, public-sector agencies, and Indigenous peoples and organisations, highlights the importance of multistakeholder engagement in ensuring that apprenticeships meet both industry needs and broader policy objectives. This approach allows the programme to remain agile, adapting training content to the immediate needs of the government of Canada's IT workforce while aligning with the skills valued in the private sector and learning preferences of the apprentice population.

However, while the programme has been successful within the context of the Canadian federal public service, its applicability across sectors will require additional design considerations. Unlike established apprenticeship models such as those governed by Canada's Red Seal programme, IT apprenticeships require a level of curriculum flexibility that may require rapid change and lack a single clear national professional organisation to monitor and regulate such a curriculum. This challenge is not unique to Canada and underscores the need for international dialogue and sharing of regulatory approaches when scaling up apprenticeship models in new sectors such as IT.

In conclusion, this case study offers valuable insights for policymakers and organisations seeking to regulate and scale up apprenticeships in dynamic sectors. It shows that success in such fields depends on flexible, responsive training models that consider employer and participant experiences, while iterating to meet industry standards. As apprenticeship models continue to expand in areas such as IT, the lessons learned from this programme provide a foundation for further experimentation and adaptation in national and international contexts.

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CHAPTER 5.

K–12 teacher registered apprenticeship programmes in the United States: expanding access to high-quality preparation to alleviate educator shortages

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5.1. Introduction

Recruiting and retaining a highly qualified, diverse teacher workforce is a perennial challenge facing schools around the world, including across the United States (NEA, 2022). This challenge became increasingly evident in 2018, when job openings began to outpace hiring, which was exacerbated by the COVID-19 pandemic ([19]). This trend did not reverse itself with the easing of the pandemic; even now, in any given month, there are nearly two job openings for every hiring and, in August 2024, 82 % of US schools reported two or more teaching vacancies (NCES, 2024).

Responding to a burgeoning educator shortage crisis, government entities at all levels increased investments in programmes that reduce barriers to entering the teaching profession, particularly among people for whom a traditional teacher preparation route is not feasible. Teacher residencies and grow-your-own (GYO) programmes are two popular alternative forms of teacher preparation focusing on recruiting and retaining a diverse teacher workforce that better reflects student demographics. Recognising the promise of these programmes, the US Department of Labor added 'K–12 teacher registered apprentice' as an occupation in 2021. Subsequently, the departments of labour and education designated substantial financial resources ([20]) to help states develop and implement K–12 teacher registered apprenticeship programmes (RAPs) ([21]). As of February 2025, 47 US states plus Puerto Rico, the US Virgin Islands and Washington DC have created RAPs in teaching (Educator Registered Apprenticeship Intermediary, 2025).

5.2. Literature review

In recent years, state and local education agencies have turned to RAPs to expand opportunities for aspiring educators and address the need for more teachers (Kriha et al., 2025). Although apprenticeships have long existed in many professions in the United States, the US Department of Labor has only

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([19]) National Education Association analysis of data from the Job Openings and Labor Turnover Survey of the US Bureau of Labour Statistics.
([20]) Thus far, RAPs have survived funding cuts and attacks on education programming by the current presidential administration. Because of the volatility of this administration, funding for RAPs may not be assured.
([21]) For more details on these investments, see this US Department of Labor blog post.

recognised registered apprenticeships for K–12 teachers since 2022. Because of this, there is limited research on the outcomes of these programmes. However, RAPs share many similarities with teacher residency and grow-your-own (GYO) programmes that have operated in the United States for several years (Garcia, n.d.).

Studies have shown that both teacher residencies and GYO programmes have had significant positive results in recruiting and retaining teachers while diversifying the profession; RAPs are likely to have similar outcomes (Regional Education Laboratory Northwest, 2024). This literature review will first provide a brief overview of registered apprenticeships in the United States. Second, it will highlight the similarities RAPs have to teacher residencies and GYO programmes. Third, it will examine the outcomes of teacher residencies and GYO programmes to discuss the potential effectiveness of registered apprenticeships for K–12 teachers.

5.2.1. A brief look at registered apprenticeships in the United States

The apprenticeship model has been utilised for generations by many nations and cultures to educate individuals in a variety of skilled trades (Gallup, 2023). The US National Apprenticeship Act of 1937 federally recognised and regulated RAPs. Although programmes vary based on industry standards and training requirements, registered apprenticeships abide by a set of core elements (Apprenticeship USA, 2024).

Box 4. **Core elements of registered apprenticeships**

- Industry-led: programmes are vetted by the industry and approved to ensure alignment with industry standards and that apprentices are trained for highly skilled, high-demand occupations.
- Paid jobs: apprentices earn wages that increase in line with their skills and productivity.
- Structured on-the-job learning: programmes provide structured on-the-job training to prepare apprentices for a successful career, including instruction from an experienced mentor.
- Supplemental education: apprentices are provided with supplemental classroom education based on employers' unique training needs, to ensure quality and success.
- Diversity: programmes are designed to reflect the communities in which they operate through strong non-discrimination, anti-harassment and recruitment practices to ensure access, equity and inclusion ([22]).
- Quality and safety: apprentices are afforded worker protections while receiving rigorous training to equip them with the skills they need to succeed and the proper training and supervision they need to be safe.
- Credentials: apprentices earn a portable, nationally recognised credential within their industry.

Source: Apprenticeship USA, 2024.

Over the last decade, RAPs have become an increasingly popular alternative to post-secondary education and on-the-job training. Between 2014 and 2024, the number of apprentices across all fields in the United States increased by 114 %, with approximately 680 000 apprentices active in 2024 (Bruno & Manzo, 2025). During that same decade, the number of graduates from RAPs grew by 143 %, with approximately 112 000 completers in 2024 (Bruno & Manzo, 2025). From 2019 to 2022, approximately 2.8 million individuals participated in a RAP, with 59 % of apprentices trained by union-led RAPs (Bruno & Manzo, 2025). Notably, union-led RAPs had a higher completion rate (61 %) than non-union RAPs (53 %). On average, apprentices participating in union-led RAPs earned higher wages than those participating in non-union RAPs (Bruno & Manzo, 2025).

([22]) The US Department of Labor recently removed the items on 'diversity' and 'quality & safety' from its promotional materials. The former version (2024) and the revised version (2025) are accessible online. We cite the former version, as the programmes we discuss in this paper were established under the earlier definition.

5.2.2. Comparing RAPs with teacher residencies and GYO programmes

Registered apprenticeships, teacher residencies and grow-your-own (GYO) programmes overlap significantly, and share the goal of creating more pathways to the teaching profession. However, each programme type is structured, operated and funded differently. Table 13 highlights some key similarities and differences between them (Garcia, n.d.) ([23]).

Table 13. **Similarities and differences among RAPs, teacher residencies and GYO programmes**

	RAPs	Teacher residencies	GYO programmes
Financial assistance	Participants are paid a progressive wage for their work	Residencies typically offer scholarships or stipends (*)	Programmes sometimes offer scholarships or stipends (*)
Certification	Participants earn state certification	Participants earn a degree and/or state certification	Some programmes result in a degree or certification (*)
Mentorship	Participants work directly with a mentor teacher	Participants work directly with a mentor teacher	Participants work directly with a mentor teacher
Funding sources	Programmes receive federal and state funding	Programmes receive federal, state and local funding (*)	Programmes receive local and state funding
Standards and coursework	Programmes develop and follow programme standards that adhere to state requirements	Programmes partner with a traditional teacher preparation programme that aligns with state standards	Programmes partner with school districts, teacher preparation programmes and sometimes community organisations that align with state standards

(*) Varies by programme.

Source: The authors.

5.2.3. Outcomes of teacher residencies and GYO programmes

Although few studies have examined the outcomes and effectiveness of registered apprenticeships, researchers have compared them to teacher residency and GYO programmes. Structurally, these programmes have many likenesses, suggesting that apprenticeships may have outcomes similar to those of teacher residencies and GYO programmes. Indicators used to measure the effectiveness of teacher residencies and GYO programmes include (a) programme recruitment and diversity, (b) teacher retention rates, (c) perceptions of programme effectiveness and (d) student outcomes.

5.2.3.1. *Programme recruitment and diversity*

Increasing recruitment and diversifying the teaching profession are common goals of residencies and GYO programmes (Afacan, 2022; Edwards & Kraft, 2024). For instance, residencies and GYO programmes expand the teacher pipeline by recruiting high school students, non-certified school staff, paraeducators ([24]), substitute teachers, community members, college students not enrolled in teacher preparation programmes and career changers (Afacan, 2022; Garcia, 2022). One study examining the recruitment efforts of GYO programmes throughout the United States found that, out of 94 programmes, 61 % targeted high school students, 40 % targeted paraeducators, 20 % targeted community members and 20 % targeted college students (Edwards & Kraft, 2024). A five-year evaluation of New York City's urban teacher residency programme found that, out of a total of 165 residents, 22 % held advanced degrees and 69 % were career changers (Sloan & Blazevski, 2015). These recruitment strategies are also found

([23]) For more on teacher residencies and registered apprenticeships, see 'Registered Apprenticeship programs and teacher residencies: Building shared understandings between workforce development and education', a brief from Prepared to Teach (Prepared to Teach, Bank Street College, 2022).

([24]) Paraeducators, also called paraprofessionals, teacher assistants or instructional aides, assist with classroom instruction and provide direct services to students and their parents. Many paraeducators work with students with special needs and contribute directly to academic achievement.

in newly emerging teacher apprenticeships.

Although research is limited, registered apprenticeships also seek to expand teacher recruitment efforts. RAPs in Missouri, New Hampshire and Tennessee recruit high school and college students, career changers, substitute teachers, paraeducators and school support staff (Reddig et al., 2024). Michigan's RAP focuses its efforts on recruiting high school students and paraeducators, while programmes in New York and South Carolina target college students and paraeducators (Reddig et al., 2024). Efforts to recruit from non-traditional sources exemplify how residencies, GYO programmes and apprenticeships work to address teacher shortages.

Recruiting racially and ethnically diverse candidates is another way that residencies and GYO programmes expand the teacher pipeline (Afacan, 2022; Garcia, 2022; Edwards & Kraft, 2024). For example, a study found that an urban special education residency programme 'recruited significantly more candidates (51 % vs. 40 %) from non-White groups' compared with other programmes operating in that city (Burnstein et al., 2023, p. 37-38). A 2016 survey of teacher residencies found that, nationally, people of colour represented 45 % of all residents, which was 'more than double the national average of teachers of color entering the field' during that time (Guha et al., 2016, p. 13). A multisite study found that 69 % of the over 2 200 participants in programmes associated with the National Center for Teacher Residencies (NCTR) identified as a person of colour. Of those, 33 % were African American and 28 % were Hispanic or Latinx (Silva et al., 2014). Looking more closely at state-specific examples, the Connecticut teacher residency programme recruits a higher percentage of people of colour than any other teacher preparation programme in that state (Rowland et al., 2024). A 2023 study considering all the teacher preparation programmes in California found that 60 % of residency candidates identified as people of colour compared with 55 % of candidates in non-residency programmes (Patrick et al., 2023).

Lastly, residencies and GYO programmes often partner with difficult-to-staff schools and recruit candidates to teach in high-needs subject areas (Guha et al., 2016; Saunders et al., 2024). For instance, resident programmes partnering with the NCTR found that 25 % of 2021/2022 graduates entered science, technology, engineering and mathematics fields, 25 % were hired as special education teachers and 83 % taught in schools that serve economically disadvantaged students (NCTR, 2023).

5.2.3.2. *Teacher retention rates*

Residencies and GYO programmes not only expand the teacher pipeline by diversifying the educator workforce but also improve teacher retention rates (Burnstein et al., 2023; Guha et al., 2016; Saunders et al., 2024). A survey of residency programmes found that retention rates among programme completers ranged from 80 % to 90 % after three years and 70 % to 80 % after five years (Guha et al., 2016). Another survey of residency programmes across the United States found that retention rates among completers ranged from 80 % to 95 % after three years (Saunders et al., 2024). An NCTR report (NCTR, 2024) reported a 78 % retention rate by resident completers' third year of teaching across 77 programmes.

Taking a closer look at local examples, Guha et al. (2016) found that 75 % of Boston teacher residents were still teaching in schools in the area after three years, compared with 51 % of teachers who did not complete a residency programme. A five-year study of the San Francisco teacher residency programme found that 78 % of residency completers remained teaching in the district, compared with 38 % of non-residency teachers (Kini & Wojcikiewicz, 2019). Lastly, Rowland et al. (2024) found that 100 % of the 2019/2020 Connecticut teacher residency cohort remained teaching four years after completing their programme.

5.2.3.3. *Perceptions of programme effectiveness*

The voices and experiences of residency and GYO programme participants are important when considering programme effectiveness. Several studies have shown that many participants believe that their programmes prepared them for the classroom (Rowland et al., 2024; Saunders et al., 2024). For instance, 86 % of the 2023 graduates reported that the Connecticut teacher residency programme

prepared them to be effective first-year teachers (Rowland et al., 2024). A California-based study of approximately 12 000 teachers found that 91 % of completers reported that the residency programme was effective or very effective in preparing educators (Patrick et al., 2023). Additionally, 97 % of graduates from the Kern rural teacher residency programme reported that they were prepared to teach in rural schools (Valente et al., 2022).

School administrators can provide valuable information on programme completers once in the classroom. Teacher evaluations from administrators in Atlanta, Denver and Memphis have indicated that residency-trained educators are 'equally or more effective than other novice teachers' (Saunders et al., 2024, p. 8). In a survey of over 200 administrators, 92 % indicated that new hires from residency programmes were more effective than first-year teachers from other pathways (NCTR, 2022). In a 2023 study, 83 % of surveyed principals reported positive gains in student achievement and school culture, and growth among mentor teachers, as a result of working with the Connecticut teacher residency programme (Rowland et al., 2024).

5.2.3.4. *Student outcomes*

Evidence suggests that teachers who complete residency and GYO programmes have a positive effect on student outcomes (Guha et al., 2016; Saunders et al., 2024). As mentioned above, studies show that these programmes recruit and prepare educators from diverse backgrounds (Afacan, 2022; Garcia, 2022; Edwards & Kraft, 2024). Native educators and educators of colour have a significant impact on all students, but especially native students and students of colour, respectively. For example, black students who were taught by black teachers in preschool and primary school not only scored higher in maths and reading on standardised tests than black students taught by white teachers, but were also more likely to graduate from high school and attend college (Dee, 2004; Egalite et al., 2015; Gershenson et al., 2017). Similar results have been found for Hispanic students taught by Hispanic teachers during early grades (Egalite et al., 2015). Moreover, increasing ethnic diversity among teachers can lower rates of disciplinary action such as suspension and expulsion among students of colour (Cheng, 2017; Lindsay & Hart, 2017).

Looking more closely at achievement, a 2015 study showed that students who were taught by residency completers 'outperformed those taught by other novice teachers on 16 out of 22 comparisons' of the New York regents exam (Sloan & Blazevski, 2015). Similarly, students taught by graduates of the Memphis teacher residency programme had higher achievement than those taught by novice teachers on the state's standardised testing programme (Tennessee Higher Education Commission, 2014). Another study found that secondary students had more academic gains and achievement in classrooms co-taught by teacher residents than students in classrooms without residents (Wilson et al., 2023).

5.2.3.5. *Critical consideration when implementing RAPs*

Preparing teachers is important work. For this reason, stakeholders must critically examine any programme before implementation. Although registered apprenticeships have a long history as an effective method of training many skilled professionals, they are new to teacher preparation. There is limited research on the effectiveness of RAPs in teaching, and further study of these programmes is needed to fully understand how they will help prepare educators and address international shortages (Afacan, 2022; Peske, 2024; Regional Education Laboratory Northwest, 2024).

Similar to residency and GYO programmes, RAPs may encounter limitations. For example, some programmes may experience difficulties in finding teachers willing to give their time and share their classrooms with programme participants. This may be particularly difficult in subject areas or locations that place a high value on high-stakes testing (Afacan, 2022). Another challenge may be finding enough recruits who are able to meet the required entrance expectations, such as passing basic skills and content area examinations (Afacan, 2022). Securing a working partnership between school districts and teacher preparation programmes may be difficult for a variety of reasons, including determining grading

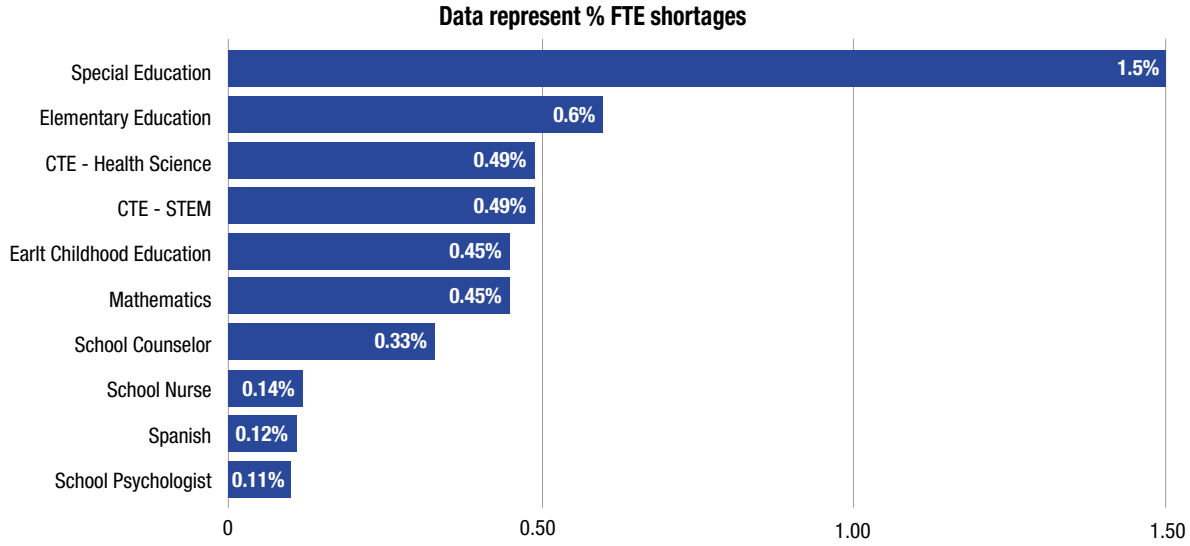
and credit policies, matching institutional values and developing an agreed-upon curriculum (Afacan, 2022). Lastly, local educational agencies may be constrained by other commitments that limit their ability to contribute financial resources and leadership time, and to participate in outreach, engagement, recruitment and selection of candidates.

Although registered apprenticeships may expand the teacher pipeline and help address educator shortages, it is worth noting the potential epistemological challenges that RAPs pose to traditional, university-led teacher preparation programmes. One critical analysis examines RAPs through a neoliberal lens, arguing that apprenticeships may prioritise labour needs to fill job vacancies over adequately preparing practitioners for the complex craft of teaching and adequately meeting student needs (Gregory, 2024). Another scholar argues that, by focusing on technical competences and practice, apprenticeships may hinder the intellectual growth and critically reflective skills that aspiring educators develop in a university setting away from the workplace (Benade, 2023). In other words, more time in a workplace setting may mean less time that apprentices are exposed to critical theories in pedagogy, child development, social justice, equity or any other valuable area of study that may be truncated (Benade, 2023).

5.3. The Washington Education Association apprenticeship residency in teaching programme

As is the case in many states, Washington's K–12 public school districts are grappling with teacher shortages, with special education being one of the most critically needed areas (Professional Educator Standards Board, 2024). Approximately 150 000 students in Washington are eligible for special education services (Office of the Washington State Auditor, 2024). However, underinvestment in the state's special education needs has resulted in difficulties in recruiting and training new teachers, high rates of turnover among existing educators and an overall workforce that does not reflect the diversity of Washington's K–12 students. As a result, children with disabilities are more likely to be taught by uncertified, underprepared individuals (Office of the Washington State Auditor, 2024), which can adversely impact children, their families, workers, employers and Washington communities.

Figure 20. **Washington statewide critical shortage areas**

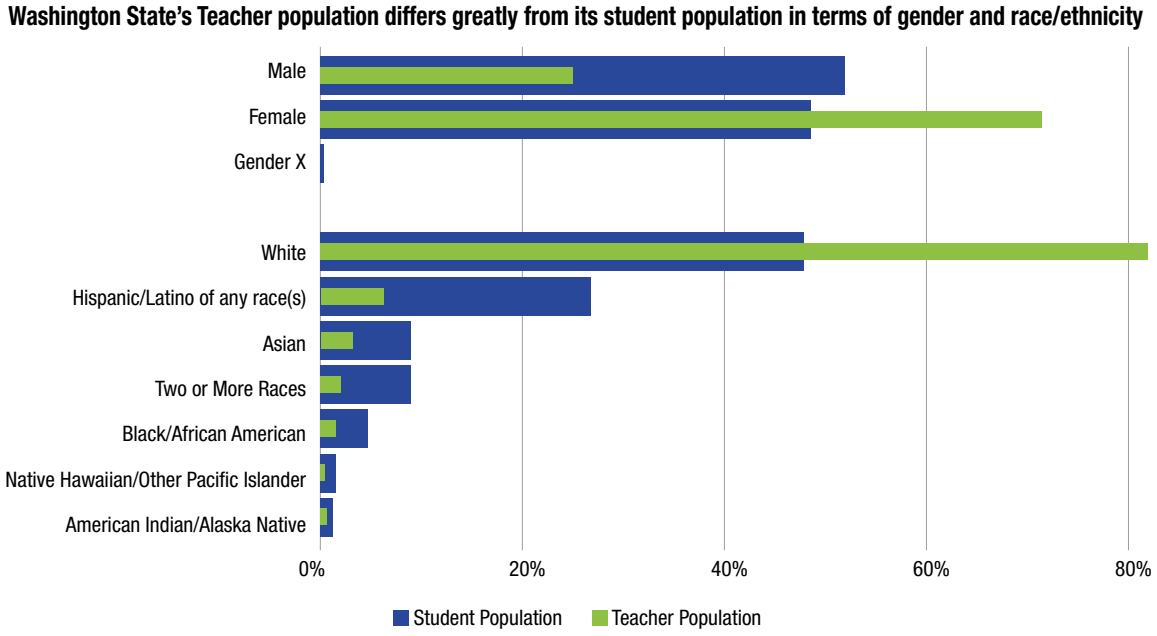


NB: CTE, career and technical education; FTE, full-time equivalent; STEM, science, technology, engineering and mathematics.

Source: Washington state Professional Educator Standards Board.

In addition, in Washington, like many other states, the gender and racial demographic make-up of the teacher workforce does not reflect the student population. For instance, over 51 % of Washington's student population identifies as male compared with less than 25 % of teachers (Office of Superintendent of Public Instruction, 2025). Moreover, native students and students of colour make up nearly 26 % of Washington's student population compared with less than 8 % of teachers (Office of Superintendent of Public Instruction, 2024). Additionally, Latino/a/x, Hispanic and Chicano/a/x students comprise over 26 % of Washington's student population compared with approximately 6 % of teachers (Office of Superintendent of Public Instruction, 2024).

Figure 21. **Washington student and teacher demographics**



Source: Washington Office of Superintendent of Public Instruction State Report Card.

To address teacher shortages in special education, the Washington Education Association launched the nation's first union-run apprenticeship programme in 2023, led by practising educators who understand the real work and true impact of skilful and inclusive instruction. The Washington Education Association apprenticeship residency in teaching (WEA ART) is a career ladder programme that provides educators already working in schools as paraeducators or as emergency substitute teachers with a full teaching certificate with an endorsement in special education. The programme removes financial and other barriers for apprentices and uses a clinical practice apprenticeship model that allows for 2 000 hours of embedded on-the-job training through co-teaching with experienced teacher mentors. WEA ART apprentices are paid a salary of at least USD 40 000, receive benefits and are covered by a collective bargaining agreement. Prior to or upon certification, they are given a conditional offer of employment with a commitment to remain for at least three years with their sponsoring school district. Moving forward, WEA ART anticipates adding additional teaching shortage endorsement areas and is considering partnerships with higher education institutions to create new degree pathways into teaching and other education roles.

5.3.1. **Mission**

The WEA Apprenticeship Residency in Teaching (WEA ART) Program provides individualized pathways to certification, preparing educators, who are a reflection of Washington's diverse learners and communities, to serve and advocate for students while disrupting and dismantling institutional systems that cause

harm to students and teachers; ensuring educator credence and excellence through application-based learning that centers inclusive, equitable practices, and prioritizes student/family centered asset-based approaches that culminate in student success.

(Washington Education Association, 2024, p. 1).

5.3.2. Core values

WEA Apprenticeship Residency in Teaching (WEA ART) Program believes in a diverse, inclusive, and equitable school community, where all students, families, and educational stakeholders work collaboratively to uphold students' rights and dignity and to dismantle unjust inequitable practices, by supporting residents' use of culturally responsive teaching methods and scientific pedagogy. Providing a quality education prepares students to actively participate in a complex and interconnected society and creates individual pathways to postsecondary success.

(Washington Education Association, 2024, p. 1).

5.3.3. Structure

WEA ART is a RAP that is approved and regulated by the Washington state Professional Educator Standards Board and the Washington State Department of Labor and Industries. Candidates must hold, at minimum, a bachelor degree in any subject area prior to beginning the programme. After completing the 18-month programme, graduates earn a Washington state residency teacher certification with a special education endorsement. Because WEA ART is a RAP, apprentices earn a progressive salary based on the district's paraeducator wage structure while completing required coursework and working directly with students.

During the programme, residents spend the first 18 weeks working as paraeducators in a partnering K–12 public school while also completing teacher preparation coursework (Table 14). They receive push-in mentoring during this first apprenticeship stage. For the following seven weeks, apprentices participate in both in-person and synchronous and asynchronous online learning. For the remaining time, apprentices are placed in classrooms to co-teach with a diverse range of experienced mentor teachers in 12-week instructional rotations. During the rotations, apprentices work directly with students but are not the instructors of record. WEA ART operates as a gradual-release model to ensure that apprentices are highly qualified and classroom-ready. While working alongside mentor teachers and completing relevant coursework, apprentices move from classroom observer to a co-teaching position with the goal of assuming the role of a full-time teacher. The process can be adjusted based on the apprentice's prior classroom experience.

Table 14. **WEA ART programme structure**

School year 1	Summer	School year 2		
January – June	June – August	September – November	December – March	April – June
Paraeducator hire coursework	Summer courses			
Rotation 1		Rotation 2	Rotation 3	Rotation 4
18 weeks	**7 weeks**	**12 weeks**	**12 weeks**	**12 weeks**

Source: The authors.

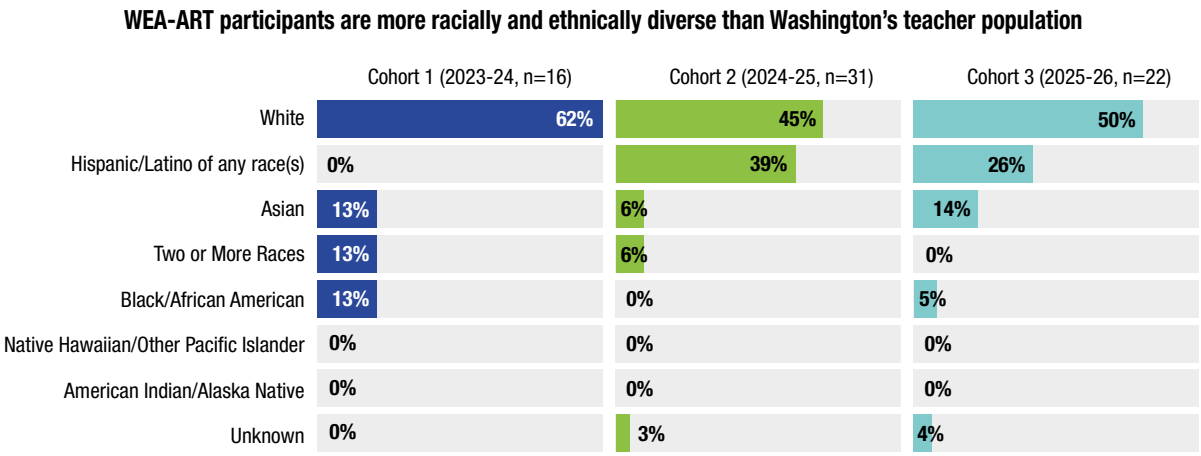
5.3.4. Initial findings

Because WEA ART launched in 2023, the programme is relatively new and, therefore, has limited evaluation data. However, analysis from a 2024 participant survey conducted by the NCTR shows early positive results (NCTR, 2024a). The following results provide insight from mentor teachers, site principals

and apprentices regarding programme and recruitment experience and satisfaction, effect on school culture and student learning, apprentice preparedness and financial sustainability.

Looking first at the demographics of WEA ART participants (Figure 22), the programme has been successful in attracting participants who are more racially and ethnically diverse than the current teacher population and far closer to the demographics of the student population. Most notably, the number of participants who are Hispanic or Latino/a/x grew considerably after the first cohort.

Figure 22. **WEA ART participant demographics**

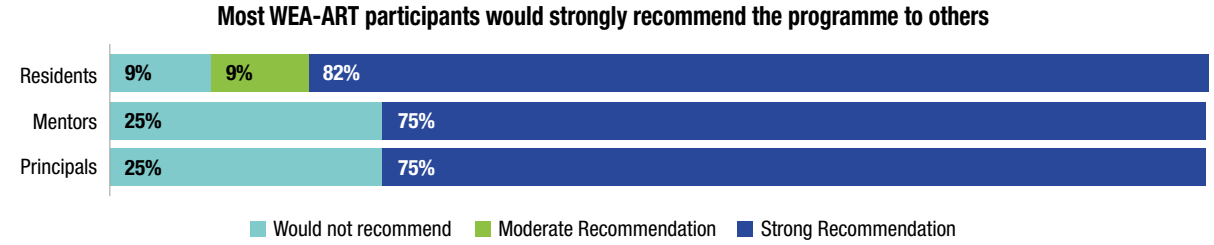


NB: Data may not sum to 100 % due to rounding.

Source: Washington Education Association.

The Washington Education Association has also been engaged in ongoing evaluation work, including surveys of participants, mentor teachers and training site principals. Approximately 75 % of participating mentor teachers and training site principals would strongly recommend WEA ART to colleagues and over 80 % of resident apprentices would recommend the programme to individuals interested in pursuing a career in teaching (NCTR, 2024b).

Figure 23. **Programme recommendation levels by participant category**



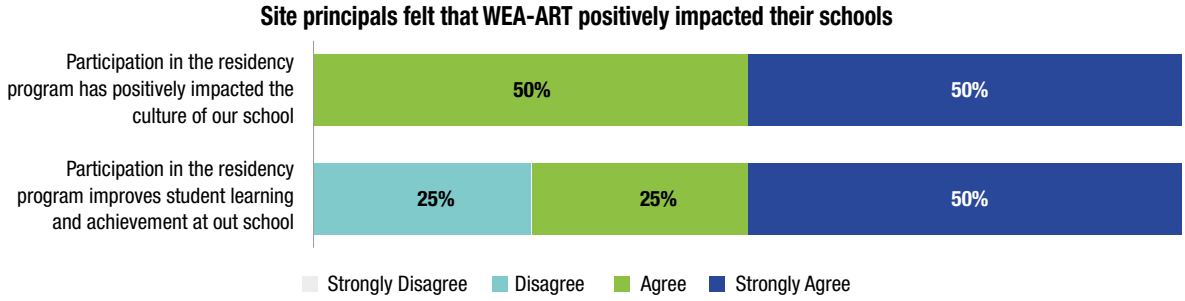
NB: Participants in each role were asked if they would recommend the programme to their peers. Those who responded with 9 or 10 on the 10-point scale were coded as 'strong recommendation', those responding between 6 and 8 as 'moderate recommendation' and those responding 5 or below as 'would not recommend'.

Source: NCTR initial evaluation (NCTR 2024b).

Survey results indicate that 100 % of site principals either agree or strongly agree that the WEA ART programme has a positive impact on school culture. Additionally, approximately 75 % of site principals either agree or strongly agree that the programme improves student learning and achievement in their schools. In the open-ended responses discussing the benefits of the WEA ART programme, one principal

stated that the programme 'allows members of our community an opportunity to become teachers who would not have otherwise had access'. Another site principal stated that the WEA ART programme is beneficial because it provides 'the potential to have more special education teachers in our system who understand our district curriculum, programmes, and policies' (NCTR, 2024b).

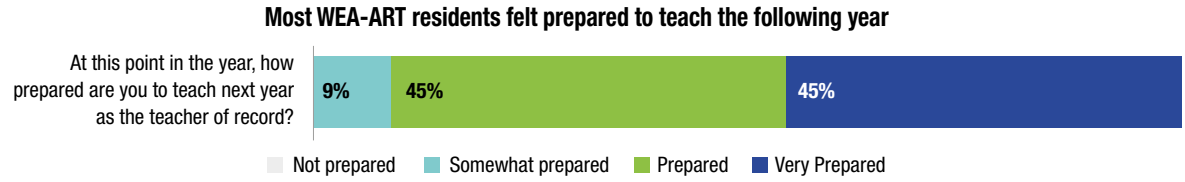
Figure 24. **Site principal perceptions**



Source: NCTR initial evaluation (NCTR, 2024b).

Initial results indicate that apprentices had an overall positive experience with the WEA ART programme. When gauging preparedness, over 90 % of apprentices responded that they were either prepared or very well prepared to teach as the teacher of record. In the open-ended questions about preparedness, one apprentice stated that the programme provides 'real experience and teaching strategies that are used day to day'. Another apprentice responded that the programme 'prepared me well for being a teacher by teaching me how to manage behaviours and develop classroom norms that cater to the students so that they can learn well'. Lastly, an apprentice said that the programme 'honestly made me feel like I have a family of current and past teachers around me' and 'I have met so many experts in the field that I feel as though I have a huge support system going forward' (NCTR, 2024b).

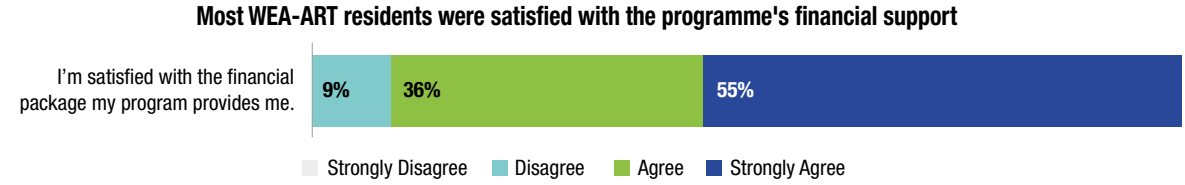
Figure 25. **Preparedness to teach**



Source: NCTR initial evaluation (NCTR, 2024b).

Like many apprenticeships, WEA ART provides financial support to apprentices during the programme. WEA ART apprentices are paid an annual salary of at least USD 40 000, receive benefits and are covered by a collective bargaining agreement. When asked if they were satisfied with the financial package that the programme provides, over 90 % of apprentices either agreed or strongly agreed (NCTR, 2024b).

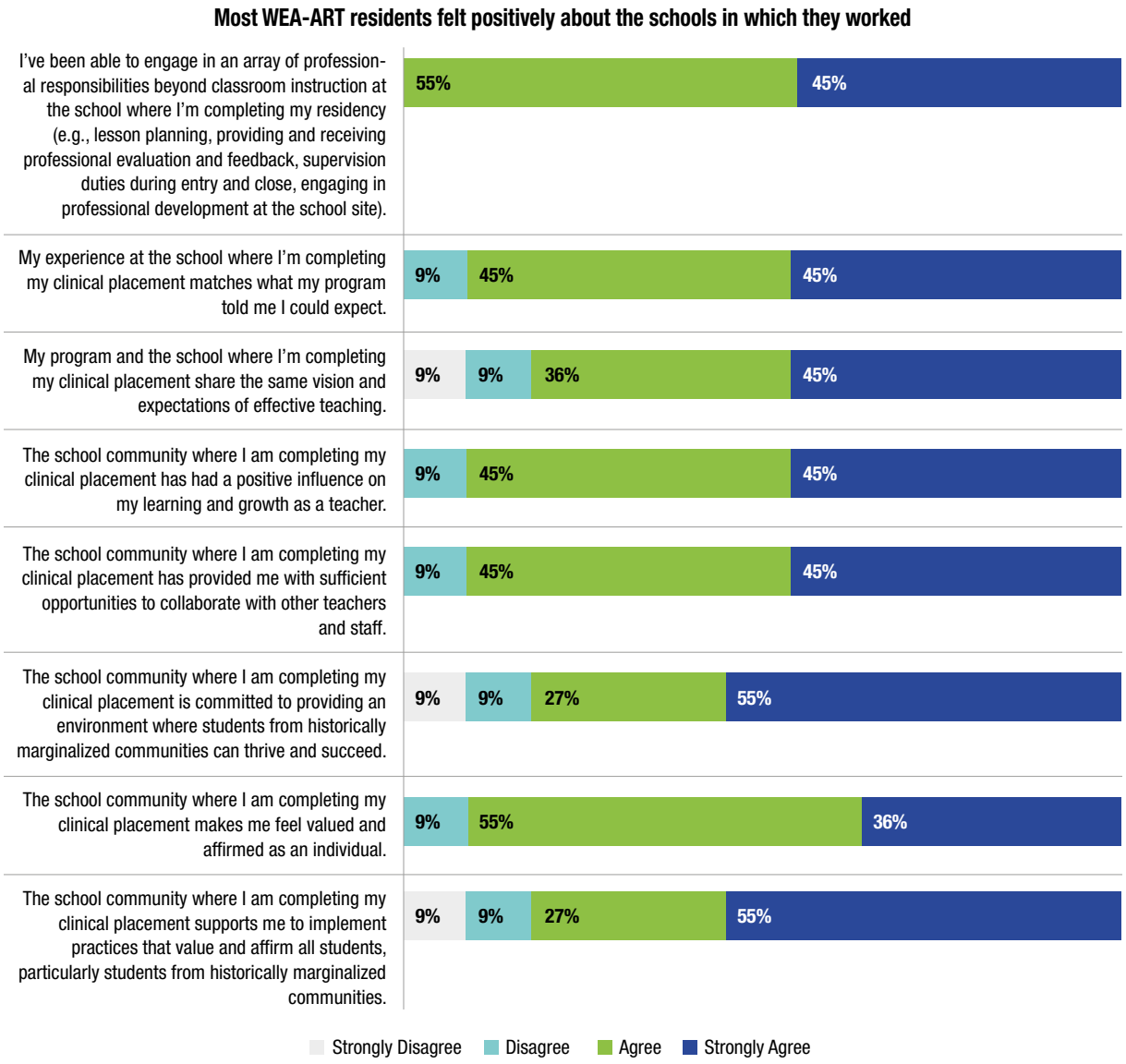
Figure 26. **Financial satisfaction**



Source: NCTR initial evaluation (NCTR, 2024b).

Likewise, apprentices had an overall positive experience in the schools where they worked. All respondents reported that they either agreed or strongly agreed that they were able to engage in an array of professional responsibilities at placement sites. Over 90 % of apprentices either agreed or strongly agreed that their experience at placement sites matched their expectations. More than 80 % of apprentices either agreed or strongly agreed that the programme and placement site shared the same vision and expectations. Over 90 % of respondents either agreed or strongly agreed that the school community had a positive influence on their learning and growth as a teacher and provided sufficient opportunities to collaborate with others. More than 80 % of apprentices either agreed or strongly agreed that the school community was committed to the success of students from historically marginalised communities and supported implementing practices that value and affirm all students, especially those from historically marginalised communities (NCTR, 2024b).

Figure 27. **School placements**



Source: NCTR initial evaluation (NCTR, 2024b).

5.4. Conclusion

RAPs such as WEA ART are among a variety of alternative teacher preparation strategies growing in popularity throughout the United States. These programmes are designed to address the difficulties in recruiting and retaining qualified and diverse educators for critical-needs areas and subjects. At the same time, RAPs, residencies and GYO programmes reduce barriers to entering the teaching profession, particularly among people for whom a traditional teacher preparation route is not feasible.

While the programme types overlap in some ways, the registered apprenticeship model stands out as an emerging, industry-led pathway to teaching. During the programme, apprentices are paid a progressive wage and provided with mentorship, on-the-job training and standards-based education that leads to teacher licensure. Although little research has been conducted on teacher RAPs, early data from WEA ART show promising results in recruiting and preparing teachers for the classroom.

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CHAPTER 6.

New forms of apprenticeship: the nursery school teaching assistant programme in Hungary

By Erika Molnárné Tóth, Ildikó Horváthné Bócsi ([25]) and Ágnes Hornyák ([26])

6.1. Introduction

6.1.1. International perspective

Since the start of the 21st century, renewing the vocational training landscape in Europe has been a major challenge, driven by evolving labour market demands. The European Union initiated such a renewal with the Copenhagen process in 2002, fostering cooperation between training structures and labour market participants, leading to a dual training system in secondary education. The Europe 2020 strategy aimed for world-class innovation, competitiveness and growth, while ensuring high levels of employment and social inclusion amid global competition, economic crises, unemployment and an ageing workforce (Cedefop, 2015).

Certain European years highlight EU priorities, such as the European Year of Youth (2022) and the European Year of Skills (2023–2024). These initiatives focus on equipping individuals with skills for high-quality employment and addressing skills shortages. The 2023 employment and social developments in Europe review report (ESDE, 2023) underscored persistent labour shortages and skills gaps in the EU. Experts, practitioners, policymakers, stakeholders and citizens across the EU are seeking solutions to these issues.

This paper presents a Hungarian initiative that both mitigates labour shortages and delineates a viable solution on how to provide prospects for young people, including those living in disadvantaged regions, by equipping them with the appropriate skills. The initiative introduces a new form of apprenticeship programme: secondary-level training of professionals in institutional education for young children. The model represents an innovative approach to vocational education, integrating theory and practice in a dual-learning format, that had not previously been applied to early childhood education in Hungary.

6.1.2. Overview of Hungarian VET and apprenticeships

Innovation policy has become crucial in Hungary, with increased support for related research. The education sector is key in supporting economic innovation and implementing new ideas (Halász & Horváth, 2017; Blenkinsop et al., 2019). A 2017 European Commission communication aimed to create a unified European education area. This includes developing a vocational and adult education system to meet job creation and economic growth challenges during the fourth industrial revolution (EEA, 2021). Secondary education's mission is to provide well-trained graduates with up-to-date knowledge and competences, contributing to regional and national economic strength.

Vocational training, linked to the economy and society, is a national policy priority in Hungary. Government decisions aim to ensure effective vocational training. The 2019 vocational education 4.0

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strategy outlines objectives for school-based vocational education. The 2019 LXXX Act on Vocational Education and Training (VET) addresses evolving labour market demands by adjusting curricula and training methods. Collaboration among businesses, educational institutions and policymakers is vital for developing programmes that meet current and future workforce needs. The VET 4.0 strategy and the 2019 VET Act led to a fundamental restructuring of training, introducing an innovative learning outcomes approach and eliminating the rigid division of theory and practice. VET programmes also cater to learners with specific backgrounds and difficulties who have dropped out or are likely to drop out of the education system, offering permeability between tracks and opportunities for further education. Vocational education includes sectoral foundation education and specialised vocational training (Cedefop, 2024).

The 2019 reforms renewed dual vocational training (apprenticeship), aiming to create a demand-driven, output-regulated VET system. Students pursue vocational qualifications listed in the Register of Vocational Occupations and receive state-recognised certificates and qualifications. The 2019 VET Act introduced a new model for apprenticeships, built around vocational employment contracts for apprentices.

Box 5. **Apprenticeships in Hungary**

Dual vocational training is offered at upper secondary and post-secondary education levels, as part of the following vocational programmes.

- **Three-year vocational school programmes (International Standard Classification of Education (ISCED) level 353, European qualifications framework (EQF) level 4) / practice-oriented VET programmes.** These provide general and vocational (sectoral foundation) education in grade 9, followed by vocational specialisation (grades 10 and 11). Since the 2019 reform, this apprenticeship type has been an option starting from grade 10 and lasts for two years.
- **Five-year technological programmes (delivered in VET schools of 5-year-long programmes, known as technicums; ISCED level 354, EQF level 4/5).** These combine general subjects and sectoral basic education (i.e. vocational training in the same economic sector has a common content) in grades 9 and 10 and vocational specialisation in grades 11–13. Since the 2019 reform, this apprenticeship type has been an option starting from grade 11 and lasts for three years.
- **One- or two-year post-secondary programmes (ISCED level 454, EQF level 5).** Since the 2019 reform, this apprenticeship type has been an option starting in the second semester and can be organised entirely at the workplace (Cedefop, 2023).

The number of apprentices under 'vocational employment contracts' in 2022 was 30 741, up from 17 355 in 2021, when the new model was first applied (Cedefop, 2023).

Source: The authors, based on Cedefop's European database on apprenticeship schemes.

Further to these developments, a notable and innovative development within the Hungarian VET system was the introduction of certified technician training, launched in 2021 and integrating academic and vocational excellence. It is an upper secondary VET programme offered in *technicums* and in post-secondary vocational training institutions. It combines rigorous academic preparation with high-quality vocational training and strongly supports student progression to both higher education and the labour market. Its key features include specialised, sector-relevant curricula delivered in collaboration with universities. The model enables a smooth transition into dual higher education programmes. Entry points after grade 8 or grade 10 provide flexibility, allowing students to catch up with higher-education-focused content by grade 11. Graduates gain a competitive edge in university admissions through extra points and the recognition of credits for bachelor programmes in the same professional field. The certified technician title denotes a higher level of expertise that is widely recognised across the Hungarian education and training landscape (Cedefop, 2025).

The programme analysed in this paper can be either a five-year technological programme or a two-year

post-secondary programme, to be achieved in a dual setting as apprenticeship (Cedefop & IKK, 2022).

6.1.3. **Methodology**

This work is based on a systematic analysis of international and domestic literature, uncovering the structural relationships set out in EU policy documents dealing with vocational training. Furthermore, we use data analysis methods to highlight the country-specific characteristics that inform targeted interventions for secondary vocational education in relation to the training of early childhood education professionals. Following this, we explore the policy documents related to the pilot programme, which reveal substantive and methodological connections concerning vocational training contracts for preschool educators.

6.2. Early childhood education in Hungary

Hungary has a nearly 200-year history of secondary training for professionals working with preschool-aged children (i.e. those aged 3–6 years) and a 65-year history of higher education for kindergarten teachers. Just as the generalisation of preschool education in 1972, along with the mass entry of women into the workforce, led to a shortage of kindergarten teachers, the country is currently witnessing a similar shortage of professionals. In Hungary, kindergarten is mandatory from the age of three, providing children with their first socialisation environment outside the family, where they encounter institutionalised forms of education and learning for the first time. In Hungary, participation in early childhood education and care (ECEC) exceeds the EU average, with 93.4 % of children aged three and older involved in ECEC (EU average: 92.5 %) (ETM, 2023). Several government family policy measures have been introduced with the aim of encouraging people to have children. As a result, an increased demand for early childhood educators is expected. Moreover, it is essential to ensure that professionals working in early childhood education are appropriately qualified, as the quality of care and education is closely linked to staff competence and training.

Box 6. **Importance of early childhood education and care**

Between the ages of three and six, children develop significant competences that lay the foundation for their later academic performance, socialisation and personality development. Consequently, countries pay considerable attention to supporting and developing ECEC in their educational policy decisions. However, it is noticeable that policies related to early childhood education show significant differences due to the varying economic and social characteristics of each country. The Organisation for Economic Co-operation and Development (OECD) indicators examining ECEC highlight that the expansion of early childhood education has seen increasing emphasis in the education policies of OECD member countries, with significantly different models in use across the countries. The international data on the deteriorating mental health of children (ETM, 2023) act as a warning in every EU Member State.

Source: The authors.

In Hungary, the qualification requirements for early childhood education staff are strict and the training structures are well established, ensuring that the quality of care and education is supported by professionally prepared personnel. Training for professionals working in kindergartens includes both vocational and higher education pathways.

(a) A kindergarten teacher must hold a higher education degree at the bachelor level (ISCED level 6). Traditionally, the most common route to becoming a kindergarten teacher is through a Bachelor of Arts degree in kindergarten education, which is a six-semester (three-year) university programme. This programme provides a strong foundation in pedagogy, psychology, methodology and language skills, and includes significant practical training periods. Kindergarten teachers are responsible for

planning and implementing educational activities that support the cognitive, emotional, social and physical development of young children.

(b) A pedagogical (teaching) assistant must hold a post-secondary vocational qualification that requires an upper secondary school leaving certificate following examinations (ISCED level 4). Pedagogical (teaching) assistants work under the supervision of kindergarten teachers and are involved in supporting educational activities, small-group work and developmental tasks, especially with children who need additional help.

(c) A childcare assistant is required to have a vocational qualification (ISCED level 3) (Eurydice, 2025). Childcare assistants support the daily care and supervision of children under the guidance of qualified kindergarten teachers, assisting with routine tasks such as feeding, dressing, maintaining hygiene and ensuring a safe and nurturing environment within the kindergarten. Their duties correspond to their lower-level vocational training, which places less emphasis on pedagogy and more on basic childcare.

In this long-established system, a new type of qualification has emerged: the nursery school teaching assistant. With a growing number of experienced kindergarten teachers approaching retirement, Hungary – like many other countries – faces a pressing challenge: a shortage of qualified early childhood professionals. This shortfall threatens the quality and accessibility of early childhood education, highlighting the urgent need for innovative strategies to attract and prepare new staff. Although Hungary has a strong tradition of training kindergarten teachers through higher education, current workforce demands call for complementary approaches. Alternative pathways – such as secondary vocational training – are being increasingly considered to ensure a steady supply of well-trained professionals.

To respond to this growing need, Hungary has introduced an apprenticeship-based training model for training teaching assistants for nursery schools. This initiative represents a significant innovation, as it offers a new pathway through vocational education. Prior to this programme, no formal vocational training for this role previously existed at this level. The newly developed apprenticeship programme directly addresses labour shortages through a practice-oriented approach, integrating structured work-based learning in real kindergarten environments, a domain traditionally dominated by higher education pathways. This study aims to present how these professionals are trained, with a particular focus on the apprenticeship component embedded in nursery school settings.

6.3. The new nursery school teaching assistant apprenticeship programme

In 2022/2023, new programmes for the education sector were introduced at the level of *technicum* training (i.e. upper secondary education). At that time, only one vocational pathway existed at this level, preparing educational support assistants for primary school teachers).

In this context, a new pathway was introduced within the education sector: the nursery school teaching assistant apprenticeship programme. It was launched in September 2024 and had the aim of addressing the increasing demand for such professionals (see Section 6.2). The programme (profession identification number: 501882502) corresponds to level 5 in both the EQF and the Hungarian qualifications framework and ISCED level 354. It is classified as an upper secondary programme that begins in grade 9, typically enrolling students at the age of 14 or 15 years ([27]).

The programme is provided as a certified technician programme – that is, a specialised track within upper secondary *technicum* education (see Section 6.1.2) that includes additional content enabling high-performing students to take an advanced path towards higher education.

([27]) The programme is available as both initial vocational education and training (IVET) and continuing vocational education and training (CVET). For CVET, the programme lasts two years, with the first six months dedicated to sectoral foundation education and the remainder dedicated to specialised vocational training, including an apprenticeship, after the student passes the required examinations.

As in all *technicum* programmes, the programme begins with a sectoral foundation phase on the broader education sector, designed to provide students with a broad introduction to this professional field. During this initial stage, students engage with common content (Box 7).

Box 7. **Content of the common sectoral foundation education**

During sectoral foundation education, grade 9 students have seven vocational subject lessons per week, increasing to nine lessons in grade 10.
These lessons are practice-oriented, which means that students focus on subjects and fields that emphasise creative production; play pedagogy; learning methodologies; dramatisation; children's literature and other forms of art, including music; physical education; self-awareness and peer awareness; and playful personality development. Experience-based pedagogy is used to convey these subjects.
During the two years of the sectoral foundation education, students visit various institutions such as crèches, kindergartens, primary schools, foster homes and vocational institutions. This observational, monitoring practice aims to provide a broad perspective. Through these field practices, students gain first-hand experience with children of different ages, helping them determine which age group they feel most connected to. This exposure not only brings them closer to these fields but also prepares them for specialised vocational subjects.

Source: The authors.

The sectoral foundation education is followed by three years of specialised vocational training. Before starting the specialised vocational training, students are required to choose between two professional pathways: nursery school teaching assistant or (primary) education support assistant. For this choice, it is essential that learners reflect on the age group that resonates most with them. Identifying the age group of children they feel most comfortable interacting with is crucial.

After completing the sectoral foundation phase, a compulsory examination must be passed (10th grade). On top of that, to embark on the nursery school teaching assistant specialisation a 'career suitability examination' is mandatory before starting training. This includes evaluations in speech aptitude (ensuring clear and understandable speech), physical education and music. These aptitude examinations and assessments are essential to become a well-trained and competent nursery school teaching assistant.

Box 8. **Content of the specialisation period**

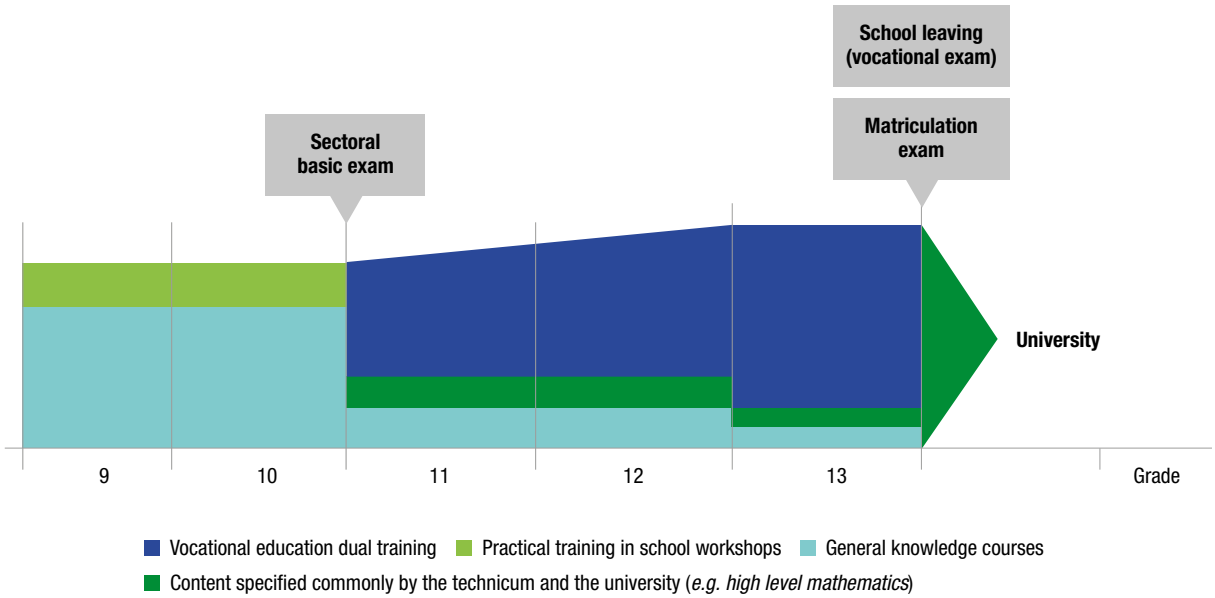
In the three years of specialised vocational training, students have 14 lessons per week in the first two years and 24 lessons per week in the final year to acquire their professional competences.
Throughout this specialisation period, students gain knowledge and develop competences in various areas, including value-creating child education; intercultural and multicultural education in kindergarten; children requiring special attention; moving from aptitude to talent; the psychology of child education; play and tale psychology; methods of activity management in kindergarten; environmentally conscious education; activities in the garden; physical activities for kindergarten-aged children; programmes inside and outside kindergarten; opportunities for tradition preservation; care and health education; health protection; personal care; first aid; child protection; the basics of mental hygiene; and the development and support of play activities and play skills.

Source: The authors.

Students are encouraged to continue their studies after obtaining their nursery school teaching assistant qualification. In fact, graduates may receive up to 30 European Credit Transfer and Accumulation System credits when they enter related bachelor degree programmes for kindergarten teachers (i.e. higher education qualifications). This credit transfer effectively shortens the duration or workload of their

university studies. Additionally, students can continue their practical training with the same institution while pursuing higher education, reinforcing the link between academic learning and industry demands. This strategy enhances the permeability of the VET system (Cedefop, 2024).

Figure 28. **Structure of technical school training**



Source: Certified technician training.

Since the programme was launched in September 2022, the number of students trained in the 'education' vocational sector has substantially increased while the number of institutions providing this training has more than doubled (Table 15).

Table 15. **Vocational sector of 'Education' in Hungary**

Academic year	Number of vocational secondary schools providing training in education	Number of VET students specialised in education
2022/2023	36	759
2023/2024	62	2 053
2024/2025	70	3 699
2025/2026	76	4 789

Source: Internet-Based Vocational Training Integrated Information System.

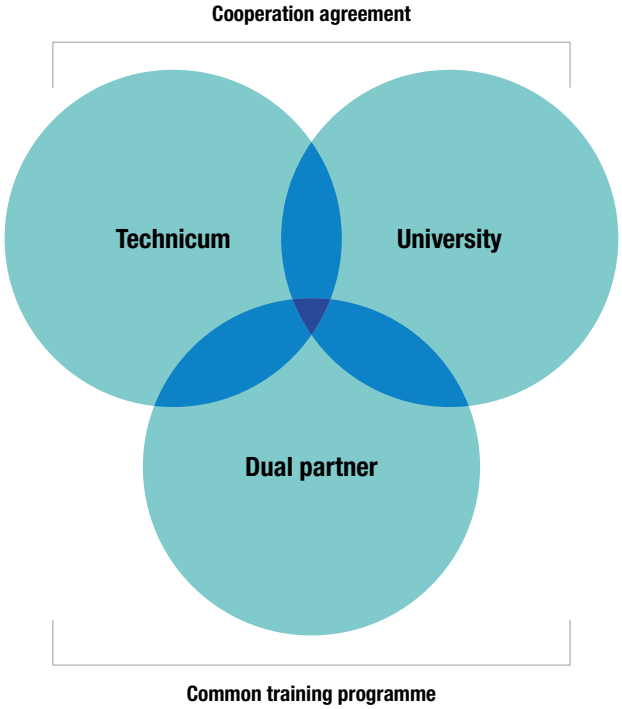
The programme was further developed by a team of educational experts in 2023. This network of professionals consisted of vocational education and university instructors and some representatives of ECEC institutions. This cooperation of various educational actors guarantees that students trained to be nursery school teaching assistants can acquire up-to-date knowledge and all the necessary skills. Local curricula delivered during the last three years of the programme are developed collaboratively between a *technicum* secondary school and a higher education institution.

6.4. Nursery school teaching assistant training as a new form of apprenticeship

One of the most significant innovations of the new nursery school teaching assistant training programme is its status as a new form of apprenticeship. The programme integrates substantial, structured work-based learning in real kindergarten settings within a certified vocational framework. Supported by policy initiatives and institutional partnerships, this model not only aligns with labour market demands but also ensures that students acquire both comprehensive theoretical knowledge and meaningful practical experience. The apprenticeship enables them to develop the skills and competences necessary to become competent, confident professionals in early childhood education settings. The apprenticeship encompasses almost 600 hours of field practice in kindergartens.

Three educational institutions0 – *technicums* (VET providers), universities and kindergartens as workplace training providers (dual partners) – equip learners with essential knowledge and experiences (Figure 29).

Figure 29. **Collaboration in the certified technician programme**



Source: The authors.

Technicums provide theoretical and practical classroom instruction on foundational skills and competences. Universities develop advanced curricula, offer higher-level theoretical insights and facilitate research opportunities. Kindergartens serve as work-based settings where nursery school teaching assistant apprentices apply their knowledge in real-life scenarios under the supervision of qualified educators, focusing on child-centred practices. This practical experience is crucial for developing competences in childcare and education. The collaboration of these three institutions through expert groups creates a comprehensive training programme. Practical experiences in kindergartens are complemented by theoretical instruction from *technicums* and universities, fostering a well-rounded, competent workforce.

Nursery school teaching assistant training includes initial training for foundational knowledge, the development of essential skills in partnership with stakeholders and hands-on experience in real-world

settings, emphasising child-centred education and care. The model allows for the adaptation of work-based learning principles to an educational environment, offering students a unique opportunity to gain real-world experience while receiving formal instruction. The training integrates theory and practice, with practical sessions designed to teach theoretical concepts more efficiently. The practical demand of each subject determines the percentage of course hours taught in practical settings, encouraging the integration of theory into practice.

Box 9. **The skills and knowledge of nursery school teaching assistants acquired during the apprenticeship**

The aim of training nursery school teaching assistants is to prepare them to be supportive professionals who assist kindergarten educators by performing caregiving, developmental support, habit-forming, organisational and administrative tasks under their guidance.
Nursery school teaching assistants facilitate communication between families and the institution, apply differentiated treatment and give special attention to children and families from disadvantaged backgrounds. They understand the stages of children's personality development and their key characteristics.
During their apprenticeship, they gradually acquire these competences and skills. By the end of their specialised vocational training, thanks to extensive direct contact with children, kindergarten teachers and parents in the nursery school environment, they become confident practitioners in their profession.

Source: The authors.

A robust quality assurance system ensures that apprentices meet required competences at a high standard, instilling confidence in their professional capabilities. National legislation imposes quality assurance obligations on kindergartens, requiring them to establish a quality management system or comply with quality criteria. Quality requirements, applicable to all dual VET providers, involve a renewed accreditation procedure by the Hungarian Chamber of Commerce and Industry and ongoing monitoring to ensure high-quality dual training placements. These measures aim to strengthen the quality and relevance of Hungary's VET system, benefiting both students and the labour market.

As stated in a study on vocational education (Cedefop & Leiner, 2024), a great challenge for VET is the insufficient collaboration with businesses, particularly in dual training, which hinders the development of sector-specific competences among students entering professional environments. This gap may result from various factors, primarily geographical and economic. However, in the case of nursery school teaching assistant training, it is guaranteed that practical and dual training can be effectively implemented. There are kindergartens in every region and nearly every settlement, and these provide the most authentic environment for apprentices to gain hands-on experience.

6.5. Advantages of using apprenticeship to train nursery school teaching assistants

The introduction of the new apprenticeship programme for nursery school teaching assistants brings several benefits to involved actors.

6.5.1. Benefits for apprentices

Becoming an apprentice in a kindergarten offers numerous benefits. Apprentices can deepen their theoretical knowledge while gaining practical experience in a nurturing, humanistic environment. This hands-on learning allows them to acquire skills with the support of well-qualified, compassionate and dedicated kindergarten teachers while earning an income, making it a valuable pathway for personal and

professional development. Individuals who enjoy engaging in play activities, singing, reciting rhymes, storytelling, drawing, painting and enthusiastically answering the countless questions posed by children aged 3–6 will thrive in a kindergarten environment and will never perceive their profession as a burden. Applicants who are passionate about creative activities and committed to supporting the physical and emotional development of preschool children will find great fulfilment – even during their apprenticeship – in ECEC, where humanistic values are at the forefront.

6.5.2. Benefits for kindergartens and other ECEC institutions

Kindergartens state that they increasingly view apprenticeship as a strategic investment for securing their future employees. Apprentices represent the next generation of caregivers and educators, bringing innovative ideas and fresh perspectives that can enhance the nurturing environment of kindergartens. Kindergarten leaders can select individuals who embody the values of empathy, creativity and dedication to child development. Through tailored programmes, apprentices develop skills aligned with the kindergarten's mission of fostering a supportive and enriching environment for children. They assume responsibilities that help to boost overall efficiency and strengthen the team's capabilities, enriching the kindergarten with essential skills. Structured supervision ensures that apprentices acquire the necessary creative, digital and technical competences, allowing kindergartens to nurture their ideal candidates. An international working group expressed that the participation of all ECEC staff in high-quality initial education and training and in continuing professional development programmes is key to improving the quality of ECEC provision (European Commission Directorate-General for Education, Youth, Sport and Culture, 2024).

Training apprentices not only improves a kindergarten's reputation within the community but also positions the institution for sustained success. Embracing apprenticeships represents a proactive approach of the kindergarten and fosters a culture of continuous growth and innovation.

Additionally, apprenticeship schemes provide financial incentives and significantly enhance the quality of care, contributing to the long-term success of the institution.

6.5.3. Benefits for the ECEC sector

Beyond benefits for apprentices and kindergartens, the pilot programme tackles numerous challenges for the ECEC sector future, enhancing the effectiveness of kindergartens and ECEC. High-quality ECEC establishes a strong foundation for future success in terms of education, wellbeing, employability and social integration. This is particularly crucial for children from disadvantaged backgrounds. Early childhood is a period that defines an individual's entire lifespan, irreplaceable from psychological, social and economic perspectives. Staff shortages in ECEC may have very severe consequences, including limited availability of (high-quality) ECEC services, which hinders the implementation of high-quality programmes; inadequate staff-to-child ratios, child safety and wellbeing; and economic impacts (European Commission, 2024).

The apprenticeship programme might contribute to addressing labour shortages, as it directly trains well-qualified ECEC professionals, which is crucial in the present situation when more and more kindergarten teachers are retiring. The programme was initiated in response to labour market, economic and social needs. It was not only the training but also the creation of a new vocational qualification that was demanded by the changing labour market, particularly the ageing and retiring kindergarten workforce. This recently established programme ensures that knowledge-based employees acquire up-to-date necessary competences to meet the diverse expectations of kindergartens, administrators, parents and other stakeholders.

6.5.4. Benefits for VET teachers

Motivating VET teachers to engage in further training, especially at a workplace, can be challenging. However, in the context of nursery school teaching assistant training, it is not particularly difficult to

encourage full-time VET educators to gain first-hand experience in nursery schools and kindergartens. They are eager to participate in the entire process of field practice, not merely as supervisors of their VET students, but as active participants themselves. This cooperation and collaboration can be mutually beneficial for all parties involved. Secondary VET teachers and kindergarten instructors exchange expertise and share innovative teaching methods with each other. This mutual learning benefits both vocational students and experienced kindergarten teachers, strengthening the entire ECEC and education sector.

6.5.5. Benefits in terms of reducing early leaving through training in authentic environments

The nursery school teaching assistant apprenticeship programme addresses the challenge of early school leaving by engaging students in immersive, practical training. This hands-on approach integrates personal and emotional development, fostering deep commitment and motivation. By providing real-world experience in kindergartens, the programme equips students with necessary skills while supporting their overall development. This comprehensive model helps retain students in the education system, preparing them for successful careers and contributing to the EU's and Hungary's goal of reducing early school leaving. Incentives for educators and professionals, scholarships and other financial aid options for students are effective ways to encourage participation and success.

6.5.6. Benefits for families with young children and female employment

Kindergartens and ECEC play a vital role in increasing employment among parents of young children by providing flexible childcare options that enable parents, especially women, to work or pursue education while ensuring that their children are cared for. Access to reliable childcare allows parents to balance personal and professional responsibilities, enhancing their workforce participation and increasing their career opportunities. ECEC programmes help parents develop transferable skills such as communication and problem-solving, improving their employability and career advancement opportunities. These settings also foster community networks that offer job connections and mentorship. Additionally, many programmes focus on supporting disadvantaged families, empowering them to overcome employment barriers and improve their socioeconomic status. Overall, ECEC is crucial in promoting women's employability by offering childcare solutions, skills development and networking opportunities. Finally, the programme provides accessible training pathways and employment opportunities to disadvantaged groups, thereby fostering inclusivity in the workforce.

6.6. Conclusion

The training of nursery school teaching assistants represents a new and significant area within Hungarian dual education (IVET and CVET). This innovative apprenticeship model ensures that a qualified educator works with students in kindergartens, unlike traditional dual education in product-based companies, where trainers often lack pedagogical qualifications. This approach guarantees a high standard of professional care and educational work with IVET and CVET participants. Further monitoring and evaluation of this case is crucial for education policy experts.

The cooperation between vocational education and dual partners must align with the findings of continuous monitoring of labour market needs. The programme is unique in its structured partnership between vocational schools, universities and kindergartens, ensuring well-rounded and research-backed training. The expert group leading the programme development, consisting of vocational education and university instructors, ensures that students acquire up-to-date knowledge through practical, competence-focused training. Recognising that students are both learners and workers, it is essential to ensure fair remuneration and safe working conditions. The continuous development of professional and infrastructural conditions can enhance the attractiveness of apprenticeship-based practical training.

Apprenticeships serve as an effective strategic solution to address the skills gap and foster a sus-

tainable workforce for the future. A significant majority of recent VET graduates and apprentices find jobs shortly after completing their programmes. However, a stable, predictable and long-term evaluation programme is needed to ensure quality assurance. The emphasis on programme quality means that IVET and CVET participants with vocational employment contracts (apprentices) should not be seen as cheap labour but should receive fair payment in line with their qualifications.

The high quality of this new programme is guaranteed by the fact that it is a certified technician programme: it is embedded within a certified technician track, offering students a clear progression path to higher education and specialised knowledge in early childhood education. What is more, it has structured quality assurance: the apprenticeship is monitored and quality-controlled by educational authorities and stakeholders, ensuring that it meets evolving educational and workforce needs. Collaboration with universities also guarantees quality, with universities playing a crucial role in developing the curriculum.

The programme involves the apprentices being exposed to qualified educators teaching and supporting children, ensuring high-quality sharing of expertise. The above aspects collectively demonstrate that this programme is not just a modified version of existing apprenticeships but a completely new and innovative approach to vocational education in early childhood education. Overall, this innovative training programme addresses the growing demand for skilled nursery school teaching assistants, equipping them with the necessary knowledge and experience through a robust dual training system.

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CHAPTER 7.

Apprenticeships as a solution in sectors experiencing labour shortages: an example from the French healthcare sector

By Romain Pigeaud ([28]) ([29])

7.1. Introduction

In France, the apprenticeship contract is an employment contract that includes a mandatory training period in an apprenticeship training centre (*Centre de Formation d'Apprentis* (CFA)). Apprentices receive remuneration from their employer. Apprenticeship training is free of charge for its beneficiaries.

The 2018 reform (Law for the Freedom to Choose One's Professional Future) fundamentally transformed the governance and financing of apprenticeships. From a system managed by the regions and subject to budgetary constraints, apprenticeships have been liberalised in both regulatory and financial terms. The reform introduced greater freedom for several actors to establish new training centre for apprentices, linked funding to contracts, extended hiring subsidies (since the COVID-19 crisis) and extended the upper age limit for starting an apprenticeship contract to 30 years (France Compétences, 2024a).

Since the COVID-19 crisis, the French apprenticeship system has experienced a substantial increase in enrolments. The number of new apprenticeship contracts signed grew from 321 038 (2018) to 849 600 (2023). As of 31 December 2023, 1 020 000 apprenticeship contracts were in effect (DARES). In addition, apprenticeships have expanded to new sectors of activity.

The healthcare sector can be considered a new field for apprenticeships, as it is among those that had a low number of apprentices before the reform. For example, in the Île-de-France region, only 1 321 apprentices were recorded in this sector in 2019.

The healthcare sector in France is generally understood to include the social and medicosocial sectors. For reasons of simplicity in this paper, reference to the healthcare sector includes these sectors as well.

Box 10. **The healthcare sector in France**

The healthcare sector in France encompasses all organisations, institutions and resources dedicated to improving, maintaining and restoring health and supporting vulnerable or disadvantaged individuals. This sector comprises three main branches:

- the healthcare branch, which covers medical and paramedical activities, including primary care and urban healthcare services, as well as the hospital system;

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- the social and medicosocial branch, which organises support for disabled, elderly or socially vulnerable populations, with the aim of promoting their autonomy and preventing exclusion;
- the ambulatory care branch, which includes so-called urban care, provided outside hospital structures.

The main professional branches of the sector notably include:

- the private non-profit health, social and medicosocial branch (BASS);
- social centres, early childhood care facilities and local social development associations.

As of 1 January 2023, the number of registered health professionals was 1 315 189. The overall estimate including all health-related occupations (e.g. nursing assistants and administrative staff) exceeds 2 million people.

Sources: The social and medico-social sector: A rapidly growing activity, with professions that are developing and diversifying and Healthcare professions – Annual data 2024.

The healthcare sector is characterised by a skills shortage affecting almost all of its professions. Professionals such as nursing assistants and nurses are particularly sought after in a context of widespread labour shortages. In this regard, the labour needs survey (INSEE, 2024) reported 330 730 projected recruitment opportunities for 2024 in the human healthcare and social work sector. The shortage of human resources in the healthcare sector is a global crisis linked to insufficient training, poor working conditions and a lack of incentive measures. All these factors contribute to driving healthcare professionals away from the regions where needs are most acute.

For instance, in nursing assistant training programmes, a decline in enrolment has been observed over several consecutive years (– 6 % between 2016 and 2018). There has also been a sharp decrease in the number of applicants for entrance exams, dropping significantly between 2014 and 2025 (– 42 %) (DRES, 2019; European Commission, 2025).

In this sector, apprenticeship programmes have emerged as a solution to diversify recruitment channels, strengthen teams and successfully transfer skills by attracting new profiles. By the end of 2023, 16 543 ‘work–study contracts’ (i.e. the total of apprenticeship and professionalisation contracts) had been signed in 2023 (OPCO Santé, 2024).

Six years after the apprenticeship reform, this paper seeks to understand the consequences of the introduction of apprenticeships in this sector by reporting on some of the initiatives that have contributed to this increase. Can apprenticeship be a solution to recruitment challenges in this sector of activity? What are the concrete outcomes of the increase in the number of apprentices, and what benefits has this growth brought to apprentices, employers and training centres? How has this increase been perceived?

7.1.1. Why, prior to the reform, was apprenticeship scarcely present in the healthcare sector?

There are a diverse range of pathways to access healthcare professions, including initial training, apprenticeships, continuing education, professional advancement, career change and validation of prior experience. Prior to the reform, apprenticeships were scarcely present in the healthcare sector.

The expansion of apprenticeships in the healthcare sector was impeded by funding limitations, as public healthcare structures and certain associations were not subject to the apprenticeship tax. Additionally, the rigidity of training frameworks often deprived employers of their apprentices: long, regulated training programmes required apprentices to complete training periods, which may not have always been possible with their primary employer. This situation compels small and medium-sized enterprises in the sector, or single-activity establishments (such as retirement homes, day-care centres and residential facilities), to establish agreements with other employers to ensure that apprentices can fulfil all mandatory training requirements.

In addition, the primary obstacles to the expansion of apprenticeships in the healthcare sector were the multiplicity of stakeholders involved in defining and implementing training policies in the sector and an excessively complex institutional and financial environment. For example, since 2005, the regions

have been tasked with determining the strategic planning of training programmes for social workers, as well as for schools and institutes providing paramedical and midwifery training, while training institutes have not easily been able to exceed quotas (*numerus clausus*) on training places.

7.2. The expansion of apprenticeships in the healthcare sector

According to figures provided by the skills operator for healthcare (Opérateur de Compétences Santé (OPCO Santé)), by the end of 2023 the healthcare sector accounted for 16 543 work–study contracts (apprenticeship contracts and professionalisation contracts), compared with 2 000 before the reform (OPCO Santé, 2024). The National Association for the Continuing Education of Hospital Staff, representing the public hospital sector, reported that 4 422 apprenticeships were completed in 2023 (ANFH, 2024). In Île-de-France, healthcare is among the fields with the highest proportions of women, with a share exceeding 80 % (L'Insitut Paris Region, 2024).

Box 11. **Skills operators and OPCO Santé**

Law No 2018-771 of 5 September 2018, on the freedom to choose one's professional future, established the skills operators (OPCO), state-approved organisations that bring together professional sector branches with a common interest in the field of vocational training. They are responsible for supporting vocational training, funding apprenticeships, assisting branches in developing professional certifications and supporting small and medium-sized enterprises in defining their training needs.
OPCO Santé is the skills operator for the healthcare branch, composed of the following four sectors: the non-profit private healthcare sector (including the social and medico-social branch), the intercompany occupational health sector, the private hospitalisation sector and the thermal spa sector.

Source: The author.

A study on the outcomes of the 2018 reform (IRES, 2024) shows that there has since been an increase in work–study programmes across various sectors: public administration, education, human health and social action. Ministerial data show an increase in the number of training offers made by CFAs in the healthcare sector.

The results in this sector illustrate the driving forces behind the widespread growth of apprenticeships in France (Cour des comptes, 2022). Approximately 4 out of 10 companies employing apprentices in 2021 reported hosting more apprentices than in 2018. The new financial incentives for apprenticeships are among the reasons cited for this increase (41 % of the relevant companies cited these as a reason). Companies also attribute this rise to an increase in available tasks that can be assigned to apprentices (32 %). Among the companies that relied more heavily on apprenticeships in 2021 than in 2018, 40 % reported finding it easier to recruit apprentices due to the expansion of training programmes or professions eligible for apprenticeships. Furthermore, 34 % cited the extension of apprenticeships to individuals aged 26–29 and 11 % mentioned the establishment of a training centre nearby.

Another study (Céreq, 2018) demonstrates that, while the quantitative objective has undeniably been achieved at the national level, this success is largely due to the emergence of new stakeholders in the apprenticeship sector. More than half of the training centres hosting apprentices in 2021 were created in 2020 or 2021. For training centres turning to apprenticeships, the increased number of apprentices provides an opportunity to diversify their student population by loosening selection criteria.

Moreover, the growth of apprenticeships appears to be fostering virtuous cycles, promoting the professionalisation of training programmes and encouraging pedagogical innovation and renewal. According to the Henart report (2009), apprenticeship has emerged in the healthcare sector in the following ways.

(a) As a means of addressing the needs of young individuals seeking to train in healthcare professions. For example, apprentices enrolled in certified care assistant programmes often come from disadvantaged social backgrounds and work during their studies. The signing of an apprenticeship contract, with the remuneration it implies, is a major factor in attractiveness, meeting the financial needs of apprentices and promoting rapid professional integration.
(b) As a tool for retaining apprentices and transforming them into future employees. For example, in terms of workforce retention, recruiting apprentices trained in nursing schools within the sector has proven to be effective, with the majority of apprentices choosing to remain with the employer after the apprenticeship contract ends.
(c) As an appealing training pathway for transmitting skills, organisational culture and the profession's ethos, and even for ensuring the retention of future professionals.
(d) As an optimal recruitment method. Companies face the challenge of addressing new skill requirements and labour shortages, and apprenticeship provides a much-needed solution to meet these evolving needs. Employers are seeking a broader range of training pathways capable of attracting and retaining future graduates prior to their graduation. It is a method of diversifying recruitment, distinct from the traditional practices in the healthcare sector, which have historically relied on competitive entrance examinations as a primary recruitment method.

The key themes are retention, integration and anticipating recruitment needs (IRES, 2024).

Testimony of Yann Reverchon, Director of CFA Praxis

Yann Reverchon notes that the recruitment of apprentices is linked to recruitment challenges. Employers often argue that 'Rather than recruiting someone, let's train them and ensure we retain them. They will become operational and develop expertise.' He states that the apprenticeship model enables:

- the transmission of a professional identity specific to the sector;
- passion for the profession to be instilled through the apprenticeship trainer (master);
- a 'passing of the torch' to new generations.

The director also notes that apprentices bring fresh perspectives to establishments, questioning existing professional practices. For employers, the growth in the workforce is always valuable, potentially compensating for the absences of other employees.

Source: Interview with the author.

Apprenticeship facilitates entry into training for individuals who were unable to pursue direct-entry programmes (initial training) due to their personal and professional lives. The remuneration provided through apprenticeship enables such people to undertake training. This is particularly evident among those over 26 years of age. Apprenticeship thus emerges as a vehicle for social diversification in workforce recruitment.

7.3. Initiatives to increase the number of apprentices in the healthcare sector

OPCO Santé has assessed the deployment of apprenticeship programmes within its member associations and companies. This comprehensive review (OPCO Santé, 2024) highlights several innovative initiatives and serves as the foundation for the examples presented below.

7.3.1. Pedagogical initiatives and enhancement of the training offer

The review shows that CFAs adapted their teaching methods and improved their support to healthcare

apprentices. For instance, the Adamss CFA has created dedicated classes for apprentices and redesigned the training for apprenticeship mentors, offering shorter formats tailored to their needs. To support its apprentices, the Amnéville Thermal Centre has created four positions for training and tutoring staff and three for trained coordinating service managers, in addition to employing a care manager and a quality manager.

The Cerfah CFA has prioritised flexibility. A noteworthy example is the possibility of 'exchanging' internship periods between employers, allowing for more tailored schedules and advantageous planning. In addition, the duration of training for nursing assistants can be extended from 12 to 18 months, providing more time for in-company practice and ensuring smooth pedagogical alternation. Other CFAs also support flexibility, offering apprentices the option to complete part of the training remotely. Generally, it has been observed that distance learning provides flexibility, facilitates the balance between studies and personal life (childcare, family life, etc.), reduces travel expenses and generates less fatigue. Apprentices are highly receptive to this format.

The Arassm CFA secured funding for three years to obtain licences for an online learning platform shared among schools. This training centre for apprentices also participates in the European Commission's self-reflection on effective learning by fostering the use of innovative educational technologies (Selfie) project (led by Slovenia), which focuses on digitalisation in training centres, schools and higher education institutions. The project aims to strengthen the connection between training periods and practical immersion, enhance attendance monitoring through better visibility of completed hours and ultimately support digital transformation in education.

To change perceptions of healthcare professions, CFA Santé Social offers modular training including professional simulations, recruitment (job dating) events, internships and visits to better understand the daily life of establishments. These initiatives particularly target individuals who have been unemployed for some time.

The SMS CFA (Social, médico-social et sanitaire CFA, in the Centre-Val de Loire region) established a working group on attractiveness and surveyed apprentices to understand the reasons for refusing or accepting offers in rural areas. The primary factor in their decision is the geographical aspect, followed by the financial aspect. One solution is to offer apprentices on-site accommodation or facilitate access to housing.

Testimony of Nelly Ivanchak, Director of Institutional Relations, Professional Branches and Partnerships at OPCO Santé

'Apprenticeship was previously uncommon in the healthcare sector, and its expansion has been correlated with adaptations. I immediately think of the training start dates, which were previously modelled on the school system with a single intake in September. However, employers' needs demonstrated a necessity for recruitment throughout the year. There have also been efforts by apprenticeship training centres to decentralise their training programmes to better cover different regions, experiments with distance or hybrid learning, and the use of new technologies such as ageing simulators and virtual or augmented reality headsets.

'Furthermore, for certain qualifications, the apprenticeship route was not initially obvious. We must remember that we are dealing with care professions! Patient safety cannot be subject to approximation! For example, for the state diploma of physiotherapist, it was necessary to clearly define the framework within which the apprentice could practise.

'This has been made possible because we were, and still are, in a period of re-engineering healthcare qualifications. This overhaul of training frameworks and their division into skill blocks allows for better consideration of the apprenticeship pathway.

We can truly say that a real dynamic has been established, on the part of all the players.'

Source: Interview with the author.

7.3.2. Initiatives of professional branches and social partners

The national joint committee for employment and vocational training (*Commission Paritaire Nationale de l'Emploi et de la Formation Professionnelle (CPNE-FP))* ([30]) of the healthcare sector (sanitary, social and medicosocial sector, SMS) contributes to the development of apprenticeship programmes in the sector. The CPNE-FP has conducted analyses and made recommendations on professional training and employment, proposing priority training actions, such as requesting that OPCO Santé develops a list of indicators for potential certification.

In collaboration with the Observatory of Professions and Qualifications ([31]), through the coordination commission of OPCO Santé, a 2025 study is expected to provide a quantitative and qualitative overview of the development of apprenticeships in the sector since the reform of 5 September 2018 and identify best practices. The objective is to propose actionable measures to better support apprenticeship growth within the sector.

The social partners of OPCO Santé have created a regional advisory council – a specific governance body dedicated to apprenticeships – to actively contribute to their development across territories. Representing the sectors covered by OPCO Santé, the council promotes the involvement of all social partners. It also ensures that territorial specificities are highlighted to local stakeholders and the OPCO Santé board of directors.

In 2020, social partners in the healthcare sector signed an agreement concerning training and skills development. Its primary goal was to support employment policies through apprenticeships. The agreement set an ambitious target for the sector: to double the number of apprentices within three years, aiming for over 4 000 apprentices by 2022 and achieving a post-apprenticeship recruitment rate of 50 %.

The sector seeks to make apprenticeships more attractive by offering remuneration levels above the legal minimum. This demonstrates the commitment of social partners to promote the recruitment and living conditions of apprentices. OPCO Santé plays a crucial role in supporting the CPNE-FP in setting reimbursement levels for apprenticeship contracts.

A special bonus has also been implemented for the apprenticeship master. In addition to transmitting skills, the apprenticeship master must demonstrate a range of abilities, such as listening, communicating and conducting an objective evaluation of the apprentice. The exercise of these duties requires being available, providing support and recognising the full range of competences needed to supervise the apprentice. Article L6223-7 of the French Labour Code stipulates that the employer must allow the apprenticeship master to allocate sufficient time within their working hours for mentoring the apprentice and maintaining relations with the training centre for apprentices. The employer must also ensure that the apprenticeship master receives training to properly fulfil their role. However, according to the Henart report (Henart, 2009), in practice these provisions often remain unimplemented, particularly within the state civil service. Therefore, the enhancement of the apprenticeship master's role was anticipated.

The 2020 social partner agreement requires that OPCO Santé supports organisations wishing to develop apprenticeship training programmes tailored to sector-specific professions, assists trainers in sector-related CFAs by providing them with training on apprenticeship pedagogy, mobilises resources to support the establishment of CFAs and promotes apprenticeship offers among young people and healthcare employers.

7.3.3. Initiatives at the regional level

The region of Normandy coordinates training start dates for institutes of nursing training throughout the year, in collaboration with regional health agencies and the regional directorates for the economy, employment, labour and solidarity (*Directions régionales de l'économie, de l'emploi, du travail et des*

([30]) The CPNE-FPs are tasked with promoting vocational training within the professional branch to which they are affiliated, in connection with the evolution of employment and skills.

([31]) The observatories for trades and qualifications (*Observatoires Prospectifs des Métiers et des Qualifications*) are expert tools supporting the employment and training policies of professional branches.

solidarités) (DREETSs) ([32]), which serve as the certifying bodies for examination boards. This approach allows individuals to join apprenticeship programmes at different times within the same year. Having already been implemented for nursing training programmes, this model will be extended to programmes for nursing assistants.

To attract candidates to this sector of activity, within the New Aquitaine region, the New Aquitaine Gerontopole has initiated a 'discovery rally of personal care professions', offering professional immersion workshops to individuals potentially interested in such careers in partnership with Cap Métiers Nouvelle-Aquitaine ([33]). Rally partners offer engaging and dynamic workshops, across seven topics, at their premises and participants are awarded a 'discovery of personal care professions' certificate ([34]).

The Regional Council of Hauts-de-France launched the Proch'Orientation initiative, which is a network of career ambassadors to further inform individuals about healthcare professions and attract candidates to the healthcare sector. The network comprises 1 700 professionals from various sectors, who can intervene in middle and high schools. This initiative addresses the need for synergy between vocational education and the public employment service to improve youth integration, not only through apprenticeships but also through direct support mechanisms inspired by best practices observed in Germany ([35]).

DREETS Auvergne-Rhône-Alpes aims to stimulate territorial dynamics to create streamlined pathways towards the diploma of nursing assistant or social and educational support worker through apprenticeships. Holders of certifications related to the Ministry of National Education or the Ministry of Agriculture can obtain exemptions, based on their diplomas, to access diplomas from the Ministry of Labour, Health and Solidarity, which are more recognised by healthcare employers.

As a result of a shortage of candidates in the health and social care sector in Auvergne-Rhône-Alpes, France Travail (the public employment service) has strengthened support for recruiters through several initiatives aiming to attract, mobilise and train new staff. Care Professions Week and calls for territorial projects are among the multiplying initiatives within the framework of close partnerships with employers and training organisations. At the end of 2021, France Travail Auvergne-Rhône-Alpes and the regional health agency launched a call for applications from the healthcare and social care sector to pool ideas and create synergies. As a result, 260 structures made a commitment to work together to accelerate candidate sourcing (Mesinfos, 2021), in partnership with all employment stakeholders such as Cap emploi ([36]), local missions, skills operators, DREETSs, etc. ([37]).

7.4. How has the expansion of apprenticeship been received?

7.4.1. **Positive reception by employers and training centres**

The increase in apprenticeship enrolments in the healthcare sector demonstrates that employers have

([32]) DREETSs serve as the single points of contact at the regional level for all matters related, in particular, to labour policy and labour inspection.

([33]) Established in 2018 by the New Aquitaine region, with the support of the state and all regional socioeconomic partners, Cap Métiers aims to provide information on guidance, training, employment and professions.

([34]) This complements other Cap Métiers tools for career information and recruitment (such as 'CMonMétier', 'CMaFormation' and 'CMonAlternance'), and new communication formats about professions, including, for example, career videos produced with the support of YouTubers. CMonMétier provides information on working conditions and expected developments in the coming years in New Aquitaine. It also offers lists of companies and direct links to websites with job, apprenticeship and vocational training opportunities.

([35]) In this context, this initiative is close to the AvenirPro pilot programme, which involved France Travail intervening in senior classes of vocational high schools. This initiative led to a 45 % increase in employment rates six months after the end of the school year, thanks to activities such as meetings with local businesses, interview preparation and identifying at-risk youth.

([36]) The public service agency dedicated to helping people with disabilities find employment or training, or transition into new careers.

([37]) 20 operational cells have been created, acting as local steering committees to create collective actions aimed at promoting their professions, inspiring interest, and facilitating integration through innovative training programmes tailored to candidates' needs. Since 1 January 2022, more than 3 000 job offers have been published through this channel and over 110 immersion actions have been scheduled (Mesinfos, 2021).

responded positively to the new opportunities for recruiting apprentices. In other words, employers have been the driving force behind the growth in apprenticeship numbers. For example, a hospital requested that a training centre in Versailles expand its cohort by 10 students to support its ambition of recruiting nursing assistants through apprenticeships. The institution plans to train between 10 and 15 nursing assistants per year for three years, adopting an approach aligned with workforce planning.

Feedback from vocational training centres regarding developments in the healthcare sector has also been positive. For example, in 2020, the Paris Parmentier Regional Institute for Social Work created a social work training centre for apprentices. 'Our applications … have risen by 30 % for apprenticeships', says Anne-Myrtille Robion-Dubois, Director of CFA Social (Centre Inffo, 2022). She goes on to say that 'Work-linked training is a response to the lack of job security among students and the recruitment difficulties in the sector.'

'It gives opportunities to people who couldn't afford the three-year training course', agrees Cédric Bourniquel, Managing Director of ADES, a social work training establishment that has set up its CFA in Lot-et-Garonne. Several schools, like ADES, have taken advantage of the reform to create their own training centre for apprentices since 2020. Such centres have been established in Montpellier, Nice, Talence and Pau, among other cities. Large employers such as the Red Cross have done the same.

Testimony of Gauthier Hemon, former apprentice and apprenticeship instructor at Paris Parmentier Regional Institute for Social Work

'I could not conceive of social work without an apprenticeship contract. This is for the simple reason that in training programmes for social-sector professions, we are constantly asked to make the link between the theory seen during our training and the practical experience, the actions carried out in our internship placements. Apprenticeship is, in my opinion, a huge advantage in creating this theory–practice link … By definition, we have more responsibilities, better immersion in our workplaces because we will be there for the entire duration of the training, as well as more time to carry out projects.

'For me, apprenticeship also represents a certain autonomy and responsibility in the implementation of one's personalised project. We have a certain accountability because the apprenticeship also means having a salary, and we must comply with labour laws. But this is precisely the strength of the apprenticeship training as well … It is rather comfortable to follow a training programme with a salary.'

Source: Interview with the author.

The reform of the apprenticeship system in 2018 made the scheme more visible and popular. 'Our enrolments have tripled in four years', says Véronique Leone (Centre Inffo, 2022), Managing Director of Interfed Santé Social – Cerfah. Between 2020 and 2024, the number of apprentices enrolled by the Cerfah CFA grew from 300 to 1 000 in all professions, with 176 nursing apprentices in 2024.

Testimony of Nelly Ivanchak, Director of Institutional Relations, Professional Branches and Partnerships, OPCO Santé

'This progression has been largely driven by the state, which has helped to make this scheme known to employers and young people. In a context where there is a shortage of many healthcare professionals, this is a real asset.

'The advantages are undeniable: for young people, it's an opportunity to secure their professional path, allowing them to acquire both training and employment. They can consider longer studies than if they were simply students. For employers, it's a real chance to diversify candidate profiles, rejuvenate their teams, or even retain employees, as it's worth noting that an apprenticeship contract can be concluded as a permanent contract.

'As for potential disadvantages, it's not so much a direct problem, but rather an organisational challenge for teams: when establishments are already at full capacity, or even understaffed, it's sometimes difficult to set aside time to supervise a young apprentice.
[…]
'Apprenticeships allow a young person to study for free while receiving remuneration. As I mentioned, apprenticeships thus make training more accessible, sometimes for long courses, such as those in the healthcare sector. And as I also mentioned, apprenticeships allow for diversification of profiles and ages of healthcare professionals.'

Source: Interview with the author.

Testimony of Alexandra Marie-Moreau and Anne-Myrtille Robion-Dubois, CFA Social
'CFA Social was created to respond to the needs of employers and to align with the opportunities presented by the 2018 law: to make apprenticeship more accessible, to offer young people remuneration during their training, to reconcile training with professional experience, to meet the needs of employers in sectors facing labour shortages, to address the need for budgetary diversification of the training centre, and in practice, to seek alternative funding sources in the face of potential reductions in pre-existing financial resources.
'The training offer was broadened with the reform, to all professions and all levels of training. Before the reform, all certifications were accessible via work–study arrangements between [the] employer and [the] training centre, even if these were not strictly apprenticeship contracts. Offering apprenticeship contracts has made it possible to develop training programmes with more time spent with the employer. The practical involvement of an apprentice is richer.'

Source: Interview with the author.

The rise in apprenticeships within the healthcare sector has occasionally necessitated adjustments to training content to ensure coherence between theoretical knowledge and practical experience gained in the workplace.

Testimony of a director of the master programme in human resources management (anonymised)
'We now have apprentices in the healthcare and social care sectors. Such profiles were previously impossible under professionalisation contracts, which were limited to the private sector. This is a significant change for us, implemented without any initial adaptation of the training content. However, this opening to the public sector, with its specific human resources requirements, might prompt us to adopt a new perspective, introduce tailored elements, and thereby enrich the training programme'.

Source: IRES, 2024.

7.4.2. Criticism in relation to the development of apprenticeships in the healthcare sector

The reception has not always been positive. For instance, the Île-de-France region stated (Centre Inffo, 2022) that the 2018 law on the freedom to choose one's professional future removes from the regions their leading role in defining the apprenticeship training map and funding CFAs. For healthcare and social care training programmes, the apprenticeship offer is no longer subject to regional authorisation or approval. As a result, the region's ability to oversee the overall training offer is limited, especially as apprenticeship is now widely embraced across various educational programmes. Nevertheless, the region has stated that it will remain committed to supporting this training pathway by evaluating requests for the creation of apprenticeship training centres or training units submitted to it.

It is worth noting that the region has not withdrawn from health and social training programmes, as

evidenced by the regional health and social training plan, which extends until 2028. Numerous calls for proposals continue to support these programmes. These include the development of nursing assistant training offer, which, in practice, is a call for projects launched by the Île-de-France region to create 150 places for entry into training programmes between September 2024 and September 2025, preparing students for the state diploma of nursing assistant.

There are also general criticisms surrounding the 2018 apprenticeship reform, which do not specifically concern apprenticeships in the healthcare sector. These recent criticisms are primarily financial, as the cost to public finances is high. The national expenditure dedicated to apprenticeships was estimated by state services to be EUR 15.3 billion in 2023. Employer social contribution exemptions amount to EUR 5.7 billion (which the employer would also have benefited from if the apprentice had been a normal employee) and unemployment insurance expenses rise to EUR 770 million (Ministry of Economics, Finance and Industrial and Digital Sovereignty, 2025).

The most significant criticism made about apprenticeships concerns the cost comparison between apprenticeship training and other pathways for the same diploma. In 2023 the unit cost of an apprentice amounted to EUR 19 263, of which 50 % is the pedagogical cost, 5 % is aid received by the apprentice and their family (excluding remuneration), 34 % is aid received by the company and 10 % is other structural costs necessary for implementing apprenticeships (France Compétences, 2024b). As a comparison, across all education levels the average expenditure per pupil or student reached EUR 9 360 in 2021 and increased by education level (DEPP, 2024). The government has implemented several measures to reduce the cost of apprenticeships, including, notably, a reduction in the bonus for employers hiring apprentices as of 2025. This allows for the continued support of apprenticeships while considering budgetary constraints.

Regarding the overall 2018 reform, according to an Institute for Economic and Social Research report (IRES, 2024), in the new 'market' framework, training centres (CFAs) must address new internal tensions and comply with new regulations. These are primarily related to enrolling more heterogeneous and fragile populations who face the specific constraints and difficulties of apprenticeship contracts and, more broadly, the challenges of alternating training. One such tension is between CFAs and employers, which can contribute to making the training path of young people more unstable and vulnerable.

7.5. Challenges for implementing apprenticeships in the healthcare sector

According to Yann Reverchon, Director of CFA Praxis, apprenticeship does not always align with the training culture in this sector. Notably, apprenticeship does not require a binding service commitment following programme completion, which is required in other certification pathways for healthcare staff. For example, hospital staff who obtain certification or diplomas through other training programmes are obligated to work within an establishment governed by the public hospital service ([38]). The absence of such a service commitment mechanism in apprenticeship means that the time invested in training through this pathway does not guarantee employers that the trained individual will remain with them ([39]).

Moreover, a training schedule whereby the apprentice is not always present at the training company's premises is not always compatible with employer expectations. Certain periods of training at the CFAs are longer than others, creating an 'absence' of the apprentice, which hampers motivation and raises questions for employers about recruiting apprentices. This issue is not always anticipated during the development of training frameworks. It is observed that employers may adopt strategies, such as recruiting in the third year of the training cycle (when apprentices are expected to spend more time at the employer's premises), to optimise the apprentice's presence at the workplace.

([38]) This obligation is often mandated by regulatory texts (e.g. Circular DHOS/RH4 of 2010).
([39]) For more legal information, see this guide.

Some qualifications have historically been outside the scope of apprenticeships, and employers remain hesitant to recruit apprentices for roles that previously did not accommodate them. Sixteen years after the Henart report (Henart, 2009), the 'culture' of vocational training through apprenticeship within the state civil service remains underdeveloped, with this pathway continuing to be uncommon and little known.

Furthermore, some employers note a discrepancy between the pedagogical content, on the one hand, and the realities of the field and their expectations as employers, on the other. Daily practical issues arising from training frameworks must also be considered. For example, if an apprentice needs to be housed near their employer, it is more convenient for them to have accommodation for a full week rather than for six days spread over two weeks. It should be noted, however, that employers can be proactive in proposing adaptations to the content of training programmes.

Article L6223-7 ([40]) of the French Labour Code stipulates that employers must allow the apprenticeship master to allocate sufficient time during their working hours for mentoring the apprentice and maintaining relationships with the CFA. However, in practice, these provisions often remain unimplemented, particularly within the state civil service. It is also challenging to secure a committed apprenticeship master, despite the presence of sector-specific bonuses, as the master must maintain their normal professional activities alongside their mentoring duties. In addition to possessing professional expertise, the apprenticeship master must demonstrate strong motivation. Fulfilling this role requires being available, providing guidance and possessing the wide range of skills needed to supervise an apprentice effectively. In some professions, the apprentice must work across multiple departments, having several trainers without establishing a stable relationship with a single master, making the monitoring and coherence of the apprenticeship journey challenging.

A negative experience can also act as a deterrent to the recruitment of future apprentices. If the employer was dissatisfied with their first apprentice, they may be reluctant to engage in the process again.

The cost of training can also be a barrier. Depending on the circumstances, training may be co-financed by employers based on a set of criteria, and the apprentice must be remunerated. Public employers, for example, may encounter funding difficulties for certain training programmes. Without funding, or with reduced funding, employers may be less inclined to recruit apprentices.

The difficulty of finding apprentices is another obstacle. The scarcity of candidates or employers necessitates extensive sourcing efforts, which requires significant human resources.

7.6. Lessons learned and conclusions

The healthcare sector continues to face a severe workforce crisis, as highlighted in the 2023 OPCO Santé activity report (OPCO Santé, 2024). It is evident that, while apprenticeships offer valuable solutions, they alone cannot overcome all the challenges faced by specific sectors (Céreq, 2018).

Some challenges to the development of apprenticeships in the healthcare sector, identified even before the 2018 reform, remain persistent.

(a) Disparities in adoption. While apprenticeships are widely implemented for nursing assistant training (shorter-duration programmes), post-secondary nursing programmes encounter greater reluctance. This hesitation stems from the significant investment required from employers and the risk of apprentices leaving for competitors.

(b) Financial constraints. The cost of apprenticeship training remains a persistent issue. This challenge is particularly evident in the healthcare sector, where the training programmes funded are long and expensive, and therefore often misaligned with annual budgetary frameworks. For example, no single

([40]) *'L'employeur permet au maître d'apprentissage de dégager sur son temps de travail les disponibilités nécessaires à l'accompagnement de l'apprenti et aux relations avec le centre de formation d'apprentis.'* ['The employer allows the apprenticeship supervisor to free up the necessary time during their working hours to support the apprentice and to maintain relations with the apprenticeship training centre.']

funding mechanism fully covers the three years of training required to become a nurse.

(c) Workforce and skills shortages. Apprenticeships have been perceived as a short- and medium-term human resources solution to address workforce and skills shortages. However, the widespread adoption of apprenticeships has also perpetuated 'glass ceilings' for traditionally under-represented groups such as women, young people with disabilities and those from urban priority areas. Although this pathway offers substantial benefits for these populations, questions remain about how effectively apprenticeships alleviate financial constraints that might otherwise hinder their pursuit of education.

(d) Sectoral attractiveness. Apprenticeships have not eliminated the lack of attractiveness of certain sectors or professions and, consequently, of the dedicated training programmes in these areas. The sector suffers from a lack of attractiveness, and companies struggle to retain their employees ([41]). Among the causes are relatively low salaries and the poor image associated with certain professions, such as nursing assistants (Mesinfos, 2021). It is crucial to understand that these issues are intrinsic to the professional services sector and extend beyond the challenges of work–study programmes alone. Apprenticeship does not appear to be the sole solution to this complex set of problems.

The solution to these issues may come from recent initiatives focused on enhancing the appeal of these professions. For instance, support programmes aiming to develop actions to improve working conditions and employment terms for employees have been implemented. This approach, which helps reduce recruitment challenges in the sector, is partly funded by DREETSs (DREETS, 2024).

The Institute for Economic and Social Research report (IRES, 2024) emphasised that apprenticeship training, now easier to implement and expand, can become a tool for increasing the number of trained young people. It promotes greater diversity among participants, enhanced security of career paths, more dynamic training pedagogy, approaches adapted to specific territories and company profiles, and, in some cases, an opportunity to foster greater democratisation in access to further education.

In conclusion, it seems impossible to overlook the positive effects of the growth of apprenticeships. For the healthcare sector in particular, this represents a renewal of its recruitment strategies.

Moreover, the benefits for apprentices need to be underlined. A recent report (INSEE, 2025) highlighted the role of apprenticeships as a 'social elevator'. In higher-level programmes, apprentices tend to come from less privileged social backgrounds than students in traditional academic pathways. Apprentices also integrate more successfully into the job market than their counterparts from traditional educational routes, particularly at the secondary education level.

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CHAPTER 8.

Changes in the nursing profession and nursing education: intentions and effects of the reform in Germany

By Karin Reiber, Bernd Reuschenbach, Markus Wochnik, Daniel Großmann, Daria Olden, Elena Tsarouha, Antje Krause-Zenß, Kristina Greißl and Viktoria Schatt ([42])

8.1. Introduction

The nursing care sector in Germany has been subjected to a profound transformation process in recent years. As a result of the strong orientation towards economic efficiency and market-based principles, the structures and processes have changed, with significant consequences for nursing care (Mohr et al., 2020). The changed framework conditions threaten the attractiveness of the nursing profession, and the persistent shortage of skilled workers could lead to a change in the professional profile, as recent research shows (Mohr & Reiber 2022).

Additionally, the demands on the profession are more diverse due to demographic shifts, advancements in medical technology and changing societal values in relation to and expectations of nursing care. This leads to nursing education being extended to other areas of professional activity. In addition to fundamental nursing skills, the abilities to implement the nursing process independently and to consider psychosocial aspects play just as important a role as communication skills.

To address changing requirements more adequately, to make the profession more attractive and to promote professional development, nursing education is currently being comprehensively redesigned: instead of the previous three separate nursing education paths, tailored to three different age groups, the new vocational nursing degree programme follows a generalist approach (Benedix & Kathmann, 2019). This generalist education is classified as European qualifications framework (EQF) level 4 and is now supplemented and expanded by a new higher education qualification pathway that allows people to gain a professional degree as part of an academic nursing degree programme at EQF level 6. This comprehensive reform of nursing education is an expression of a changing professional profile with the self-concept of providing comprehensive support to people of all ages in different care sectors and settings that is integrated into multiprofessional teams; complies and aligns with ethical principles, legal guidelines and economic conditions; and is scientifically sound. The generalist education represents an expansion, as it now qualifies apprentices for very different nursing care sectors.

The two new forms of education – the vocational nursing degree and the university degree with a professional qualification programme – aim to increase the attractiveness of the sector by enabling students to qualify for different fields of work and activity, and – in the case of nursing studies, for the first time – in an academic way (BMFSFJ, 2020). On the other hand, they are supposed to provide adequate educational pathways for the changing nursing profession prompted by demographic change, more complex care situations and changing needs and preferences of those affected (BMFSFJ & BMG, 2018).

The nursing education reform can therefore be seen as an expression of a further development of

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the occupational profile in response to external developments such as multimorbidity, very old age and changing needs, on the one hand, and as a consequence of internal professionalisation tendencies within the occupational group, on the other.

This paper discusses the implications and consequences of these changes based on the results of the accompanying research on the implementation of the new nursing degree programmes, which is being conducted by a consortium on behalf of the Federal Institute for Vocational Education and Training (Bundesinstitut für Berufsbildung (BIBB)). The paper refers only to findings on the vocational nursing degree programme; the results of the university degree programme are not discussed ([43]).

8.2. The reason for and context of the nursing education reform

8.2.1. Changes in the nursing (education) system

Professional nursing has changed in recent decades. Over time, a typically female profession in the shadow of medicine has increasingly come to see itself as an independent profession with an awareness of its own profession-specific knowledge base (Reiber, 2024). In the context of the emerging, differentiating and consolidating vocational education research, the constitutive professional competences can be precisely conceptualised, prescriptively determined and empirically examined regarding the requirements of nursing care. Complementing this, the development of nursing science is accompanied by a significant increase in findings on the changing requirements and contexts of nursing care. Care situations are becoming more complex due to overlapping and possibly mutually reinforcing problem situations, a change in the behaviour of those in need of care and/or their relatives and the increasing importance of cooperation within an organisation and between institutions. These changing job characteristics are framed by increasing economisation, a change in professional ethics (i.e. viewing care as a job instead of a calling; Starystach et al., 2018) and a persistent shortage of skilled workers, leading to a qualitative and quantitative limitation of nursing care (Reiber, 2024).

The new nursing professions act (Pflegeberufereformgesetz (PflBRefG)), which came into force in 2020, aims to make professional nursing more attractive to ensure a sufficient supply of skilled workers and to future-proof the profession considering the changing care situations and contexts. Like in the case of other regulated professions that are highly relevant to public welfare and safety, nursing education is regulated by its own professional law (Wollnik, 2012).

8.2.2. Main changes to nursing education

Demographic change is also a key motive for the training reform in nursing: like all occupations, nursing is affected by smaller birth cohorts of young people interested in training. In contrast to other occupations, however, the situation is exacerbated in nursing care by the fact that the demand for nursing care is increasing exponentially due to the ageing society, and thus a smaller potential workforce is facing steadily growing demand (Heger, 2021). The new training system aims to make the profession more attractive by broadening the range of professional activities, thereby enhancing the professional flexibility of nursing professionals (Vogler & Herzberg, 2023). This, in turn, not only makes the profession more attractive but also supports the employment and health policy goal of ensuring the supply of skilled workers for all care sectors and settings (Tsarouha et al., 2022). Furthermore, the comparability of training across Europe is an important argument: the generalist occupational profile corresponds more closely to international practice. The number of theory hours have been adapted to those of other European countries (Benedix & Kathmann, 2019).

Since 1 January 2020, nursing training in Germany has undergone fundamental changes as part of the implementation of the Nursing Profession Reform Act (Pflegeberufereformgesetz (PflBRefG)). The

([43]) Results regarding the university degree with professional qualification programme are discussed in Olden et al., 2023.

aim of this reform was to modernise the nursing profession, improve the quality of training and increase professional mobility within Europe.

Previously, nursing training was divided into three separate training pathways: health and nursing care, health and paediatric nursing and geriatric nursing. Each of these professions had specific training regulations, each with different focuses, practical fields and curricula. The educational requirements and content of the training also varied between the training programmes. In all three cases, the training lasted three years on a full-time basis. In the EQF, the three training programmes were generally classified at level 4, analogous to their classification in the German qualifications framework.

With the reform, these specialised training courses have been replaced by the introduction of generalist nursing training and merged into a single profession: that of registered nurse. With the entry into force of the Nursing Professions Act (Pflegeberufegesetz (PflBG)) and the Training and Examination Regulations for the Nursing Professions (Pflegeberufe-Ausbildungs- und -Prüfungsverordnung (PflAPrV)), a generalist training programme was introduced, compliant with EU standards. The training programme combines all three previous specialisations into one profession with a common qualification as a registered nurse. After two years, learners have the option of continuing their generalist training or specialising in geriatric care or health and paediatric nursing.

The new training programme is also designed to last three years on a full-time basis (or up to five years on a part-time basis) and comprises the following elements, with the number of compulsory hours remaining unchanged:

(a) theoretical and practical instruction: 2 100 hours;
(b) practical training: 2 500 hours.

The practical part takes place in ‘care facilities with cooperation agreements’ to ensure that placements cover all relevant areas of care (inpatient acute care, inpatient long-term care, outpatient care, etc.).

With the introduction of generalist nursing training, its classification in the EQF and the German qualifications framework at level 4 was also confirmed, although there has been an increasing tendency towards assessment at level 5.

The reform of nursing training represents a profound structural and content-related change that both considers the nursing care needs of an ageing society and strengthens mobility and recognition within the EU. It creates a modernised, broad-based professional qualification that facilitates access to academic careers and is intended to make the nursing profession more attractive in the long term.

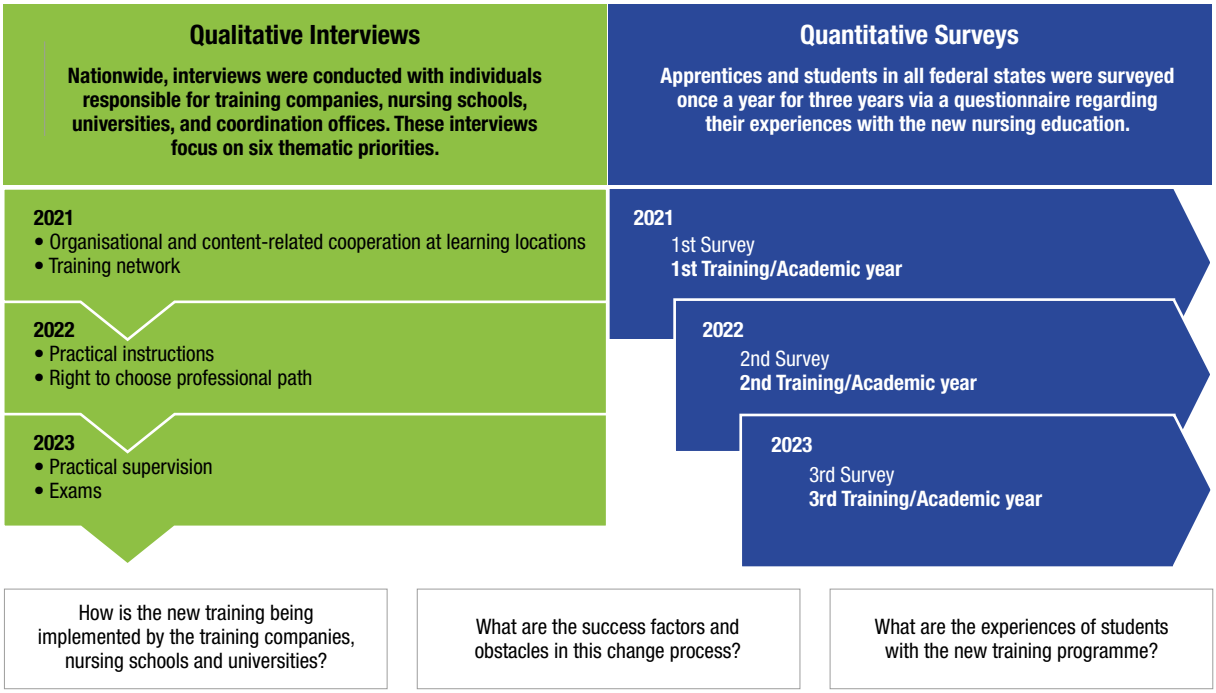
The degree to which students find the new generalist qualification more attractive, and whether it meets expectations for greater professional flexibility and compatibility, is a subject of research and will be discussed in this paper.

8.2.3. **Research on the introduction of the new nursing education**

The project ‘Accompanying research on the change process for the introduction of the new nursing education’ (BENP) is being carried out by a consortium consisting of the German Research Institute for Vocational Education and Training (Forschungsinstitut Betriebliche Bildung), Esslingen University of Applied Sciences and the Catholic University of Applied Sciences Munich as part of an overarching research project commissioned by the BIBB.

The aim is twofold: to gain insights into the implementation of the new nursing education and to examine how the actors shape this process. In addition, the experiences of the apprentices with the new vocational education are surveyed in a longitudinal study. Both project strands (qualitative and quantitative) are outlined in Figure 30 and the subsections below.

Figure 30. **Research design**



Source: The authors.

8.2.3.1. *Qualitative interviews*

The qualitative interviews primarily aim to capture the experiences of the implementation stakeholders through semistructured interviews. Depending on the topic, stakeholders from schools, universities and companies are included. In addition to interviewees in management positions, people who are directly involved in practical implementation are also interviewed, for example those who carry out the practical training in the companies as part of the apprenticeship programme. The nationwide surveys and a total of approximately 400 interviews were on the following key topics: organisational and content-related learning venue cooperation, training alliances, practical guidance, the right to choose a vocational qualification, practical support and examinations. Specific interview instruments (guides) were developed and used for each key topic. The interviews were evaluated using content analysis in accordance with Kuckartz (2016), whereby qualitative pre-selection of the aspects to be evaluated in more depth was carried out. The discussions with the various interviewees focused primarily on questions regarding structural change processes, challenges and opportunities, and the identification of development potential and areas in need of improvement. The most important changes are discussed in more detail in Section 8.4.

Information on the discussions on the topic of practical guidance and the right to choose vocational qualifications is provided in Table 16.

Table 16. **Overview of interviews on practical guidance and the right to choose a qualification**

Topic	Number of interviews	Participants	Time period
Right to choose a qualification	80	Key/leadership personnel from (a) partner institutions for practical training within nursing education and (b) nursing schools	September–December 2022

Source: The authors.

8.2.3.2. *Quantitative survey*

The apprentices' experiences with the generalist vocational nursing degree programme were collected by a longitudinal panel survey. The nationwide online survey addressed apprentices who started their vocational nursing degree programme in 2020, with three survey periods: in the summer and autumn of 2021, 2022 and. The main topics were (a) motives for occupational choice and professional prospects, (b) learning conditions at the nursing school, (c) learning conditions at the practice sites, (d) the structure/organisation of the vocational nursing degree programme and (e) the overall evaluation of nursing education (Olden et al., 2023). In addition to a series of items that were used in all three survey periods, topics of specific relevance for the phase in question were also included. Thus, the first survey asked about experiences during the orientation assignment and about expectations of nursing education. The second and third surveys asked about learning during the practical assignments. The third survey also addressed the transition to professional work. Students were recruited through nursing schools in all federal states. A total of 1 268 students were reached in the first survey period, 851 in the second and 712 in the third.

In the area of practical instruction, students were asked to rate, on a six-point Likert scale, the relevance and implementation of practical instruction, the quality of practical instruction and the number and duration of practical instruction sessions. During the first and second survey periods, students were asked about their preferences regarding the vocational qualification they planned to choose. In the third period, they were asked which vocational degree they chose.

8.3. Findings at a glance: choice of separate professional degrees

The German vocational nursing degree programme allows apprentices to choose separate professional degrees in paediatric nursing (*Gesundheits-/Kinderkrankenpfleger/in)* or geriatric nursing (*Altenpfleger/in)* instead of the general professional degree in nursing (*Pflegefachmann/Pflegefachfrau*) (§ 59 PflBG). The decision to pursue a separate vocational degree is possible up to the end of the second year of programme and requires a specialisation in the chosen field of nursing during the third year of apprenticeship, with a corresponding curriculum and practical assignments. At the school level, for example, this means that it is desirable to have teachers with the relevant theoretical expertise and practical experience in the team. There is no obligation to offer the separate degrees, but the practical training providers are obliged to inform the apprentices about their right to choose and to advise them on this.

The interest of apprentices in one of the separate vocational degrees was very low in the first generalist cohort. This was already apparent in the first two survey periods (Olden et al., 2023) and became more concrete in the third period when looking at the qualifications that students ultimately chose (see Figure 31). This is further evidenced by the fact that only 14.3 % of respondents with a specialisation in paediatric nursing chose the corresponding separate vocational degree. Among those respondents who specialised in geriatric care or home care with a focus on geriatric care, only 1.7 % chose the corresponding specialised degree.

Figure 31. **Choice of professional nursing degree in the third year of the vocational nursing degree programme**

NB*: Question: 'With which professional nursing degree will you complete your vocational nursing degree programme?' (n = 687).*

Source: The authors' own accompanying research on the process of change for the introduction of the new nursing education.

The survey of training managers also shows that the actual use of the right to choose is limited: only a few institutions offer separate qualifications at all – when they do, these are slightly more frequent in paediatric nursing. The majority limit themselves to general qualifications. Even where separate qualifications are offered, apprentices rarely exercise their right to choose. The geriatric nursing qualification is particularly unpopular. Organisational and structural hurdles are the main reasons for not exercising the right to choose:

(a) nursing schools lack the teaching staff, premises and financial resources to develop and implement specialised curricula;
(b) the late decision-making point (at the end of the second year of training) causes considerable planning uncertainty;
(c) in many regions, there are no suitable practical training places, especially in paediatrics.

Criticism of the content concerns the limited depth and duration of specialisation, especially in paediatric nursing. Practical and theoretical training is often insufficient to impart sound paediatric skills.

The majority of those responsible for training who were surveyed are in favour of generalist training as a strong foundation. Later specialisation – for example through structured further training – is considered more sensible and future-proof than separate parallel qualifications, which are seen as backward-looking.

Both apprentices and training managers complain about a lack of clarity regarding the legal and practical consequences of the right to choose. They raise the following questions.

(a) What professional restrictions or opportunities arise from a separate qualification?
(b) How long will the right to choose actually remain in place?

The accompanying research concludes that generalist nursing training is fundamentally suitable for meeting complex care requirements. However, additional further training is needed to better cover specific areas such as paediatric nursing. Separate qualifications are mostly seen as an organisational burden, educationally questionable and unnecessary in terms of content. It therefore seems unlikely that the option will be established permanently.

8.4. Reform or minor reform?

Both the nursing profession and nursing education have developed steadily, with the demands of the field of employment being a key factor in this development. The historical development of nursing education has always been characterised by adjustments in content and structure in response to changing requirements. However, under previous laws, other stakeholders, such as those representing the medical profession, had significantly greater influence also on (paediatric) nursing regulations. In this respect, the 2020 nursing profession act is also a sign of the nursing profession's self-empowerment. During the current reform, the profession was able to implement long-prepared paradigmatic changes that are seen as indicators of its further professionalisation.

The topic of the right to choose makes certain trends in the evaluation of generalist training particularly clear. A mostly fundamentally positive attitude towards the new nursing training regulation is offset by concerns regarding specific professional requirements. This is particularly evident in paediatric care, since the separate qualification offered here is noticeably more frequently chosen than that in geriatric care. Access to certain areas of paediatrics during training is subject to restrictions, which can lead to students completing their mandatory paediatric placement in a practice area in which they cannot adequately acquire paediatric-specific nursing skills. Due to a lack of adequate, structurally anchored further training opportunities, nursing schools are often still unable to provide reliable career advice on further specialisation in paediatric nursing.

There seems to be uncertainty surrounding the right to choose on the part of both providers and stu-

dents. In the various sectors of nursing care, there has been and continues to be controversy regarding whether it made sense to maintain the separate vocational qualifications within the framework of a right to choose before evaluating its use to finally decide in December 2025 whether to switch consistently to general nursing (§ 62 PflBG). The fact that the right to choose was included in the law – in deviation from the key issues paper and draft law that preceded the adopted law – is due to the controversial discussion about whether general studies are sufficient for the specific requirements of certain paediatric care areas and the argument that the generalist qualification could make the provision of specialist staff in geriatric care more difficult.

From a professional policy perspective, consistent implementation of generalist training without granting an option for specialisation would have been desirable and in this respect the reform does not go far enough. On the other hand, this compromise was also necessary to ensure broad acceptance of the new training. From the point of view of the accompanying research, the training reform has met with broad approval on the one hand. On the other hand, it has been shown that in some places a separate qualification cannot be offered due to practical constraints, meaning that the comparatively low number of separate qualifications on offer cannot be interpreted in every case as convinced approval of the generalist approach.

8.5. Conclusion and outlook

The reform of nursing training was preceded by lengthy professional and political discussions, and model projects to test early versions and forms of generalist studies (Peters et al., 2023). The aim of the reform is to make the occupational and vocational training more attractive to potential candidates and to open up a range of professional development opportunities. At the same time, the new nursing training claims to adequately address the professional requirements of the healthcare system. For the occupational group itself, the legally defined tasks in particular represent a milestone on the road to professionalisation and self-determination.

On behalf of the Federal Ministry of Health and the Federal Ministry for Education, Family Affairs, Senior Citizens, Women and Youth, the BIBB is currently implementing a research programme to ensure that future political decisions are more research based (Dorin et al., 2024). The accompanying research reported here is part of this research programme.

The accompanying research shows how the reform is being implemented based on the perspectives of all groups of stakeholders offering theoretical and practical training, and students. In the synopsis of all qualitative surveys and data collection waves of the longitudinal panel study conducted so far, it can be stated that the training reform is on the right track: the training stakeholders are committed to implementing the reform in theory and practice, and, when limitations arise, creative solutions are found in some cases. Nevertheless, emerging challenges in the practical implementation require a differentiated view of this transformation. These include personnel and structural restrictions, such as a lack of opportunities for in-depth study during practical placements and the limited availability of specialist staff.

The implementation of the reform is still in the early stages and there are still desiderata in various areas (Olden et al., 2023). In view of the time periods required for such a comprehensive transformation as the nursing profession reform, further monitoring of the following adaptation processes, on the one hand, and the stabilisation of the changes made and their medium- and long-term systemic consequences, on the other, is necessary, especially regarding nursing care.

The new Nursing Professions Act was preceded by model projects that were also scientifically evaluated. However, it is not apparent that findings from vocational education and training research were incorporated into the development and discussion of the new Nursing Professions Act, although policymakers have committed themselves to basing political decisions more strongly on scientific findings (Dorin et al., 2024).

The law itself transferred research and development tasks related to the nursing profession and nursing training to the BIBB as a federal research institution. The results are to feed into the political discussions and can be used for readjustments. Further studies are needed to critically accompany the ongoing reform process and to provide comprehensive insights for the sustainable further development of nursing education in Germany. With this stronger evidence base for education management, the nursing domain can become a paradigm for intensified cooperation between science and politics, which can be emulated for vocational training reforms in other fields.

Countries seeking to introduce nursing apprenticeship programmes can draw valuable lessons from Germany's comprehensive nursing education reform, which demonstrates both critical success factors and potential pitfalls in transforming vocational nursing education.

One of the most critical challenges identified in the German implementation is ensuring sufficient training capacity, particularly in the form of qualified practical instructors. German research shows that only about 1 in 5 students receives the legally required amount of practical instruction, primarily due to shortages of trained practical instructors, who must often perform regular nursing tasks instead of providing structured training. This highlights the essential need for countries to plan and invest in training instructor capacity before expanding programmes, ensuring adequate availability of qualified workplace trainers who can dedicate adequate time to educational responsibilities.

Research is essential for successful implementation. Germany's accompanying research project, conducted by a consortium on behalf of the BIBB, employs mixed-method designs to examine implementation from all stakeholder perspectives. This research reveals that, while the training reform is fundamentally on track, with high stakeholder commitment, structural and personnel restrictions create significant implementation challenges.

The reform's success in making nursing education more attractive while addressing evolving professional requirements depends on maintaining occupation-specific focus, ensuring adequate instructor capacity, providing comprehensive trainer preparation, strategically increasing workplace-based learning and supporting implementation with continuous research. Countries should prioritise developing sustainable financing structures, establishing robust quality assurance mechanisms from the outset and planning for multiyear transformation processes with iterative improvements based on evidence. The German case confirms that successful nursing education reforms are achievable but require systematic planning, sufficient (research) resources, stakeholder engagement and a long-term commitment to evidence-based adaptation.

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CHAPTER 9.

Scaffolding: the case for apprenticeship

By Linda Clarke ([44]), Fernando Durán-Palma ([45]) and Christopher Winch ([46])

9.1. Introduction

Scaffolding has been transformed in the post-war period to become a recognised occupation in many European countries, accompanied by often obligatory vocational education and training (VET). In Germany, for instance, rather than being simply an activity carried out in the process of building, scaffolding became a recognised occupation in 1991 and a full *Beruf* in 1998, with a three-year apprenticeship programme resulting in a formal qualification. However, certified training has been more common than apprenticeship, as in Denmark, where, given the dangerous nature of the work, in 1997 it was required that no one should erect or dismantle scaffolding over three metres high without specialist training.

In 2021, a two-year construction apprenticeship programme was introduced in Ireland, including on-the job training with an approved employer and off-the-job training at the National Construction Training Campus (in the purpose-built scaffolding apprenticeship building) to become a fully qualified scaffolder. This apprenticeship exists alongside the formal training certification requirement for scaffolding, including occupational safety and health (OSH) training under the construction skills certification scheme (CSCS) for basic and advanced scaffolding. In contrast to Ireland, the case of the Netherlands provides a warning in that the scaffolding apprenticeship programme, which contained an on-the-job pathway and a classroom-based element including, for instance, Dutch, maths and citizenship, is no longer offered because of lack of enrolment. Instead, Safe Working at Height Foundation certification is preferred. This was established in 2016 to demonstrate professional competence; it is only for those over 18 years old and consists of courses to become an assistant scaffolder, a scaffolder, a chief scaffolder, a scaffolding foreperson, a scaffolding inspector and a supervisor of scaffolding in use.

The introduction of a new scaffolding apprenticeship in Ireland and the simultaneous demise of the Dutch scaffolding apprenticeship raise many questions pertinent to this publication, which this paper seeks to address. Are these changes attributable to the nature of the apprenticeship and the VET system in place, to labour market conditions, to the role of the social partners or to a combination of factors? We draw on an EU-funded project of the European Federation of Building and Woodworkers (EFBWW) conducted between 2023 and 2024: 'Improving training, working conditions, and transformation in the European scaffolding sector' (Scaffold). This project details the state of scaffolding and scaffolding VET in six European countries: Belgium, Denmark, Germany, Ireland, the Netherlands and Poland (EFBWW, 2024a, b; Durán-Palma et al., 2024). In this paper, we discuss the nature of scaffolding work, assess and compare attempts to ground scaffolding as an apprentice occupation in Denmark, Germany and Ireland, and put forward recommendations on common standards for scaffolding apprenticeship in Europe. The variation in the form that scaffolding apprenticeship takes, as illustrated in these three countries, provides valuable insights into the opportunities and challenges of introducing apprenticeships more widely across Europe into what, in the case of scaffolding, is becoming an ever more complex activity.

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9.1.1. What is scaffolding?

The activity of scaffolding is summarised in reference to the English standard apprenticeship for scaffolding:

Erecting, altering and dismantling scaffolding, to allow other trades to work safely at height from secure working platforms.

(Institute for Apprenticeships and Technical Education, 2023)

This is sufficient as a brief summary of what scaffolders do. It does not, however, do justice to scaffolding as an occupation. Indeed, when considered an integrated activity, the work of scaffolders is a species of project management involving planning, execution, problem-solving, finishing and evaluation. The EFBWW final report of 2024 goes into this in more detail, showing that the work of scaffolders is based on a cycle of activity (Durán-Palma et al., 2024). Not all scaffolding workers fully participate in all aspects but, within the hierarchy of qualified scaffolding work, the following broadly consecutive functions can be identified:

(a) scoping work to be undertaken;
(b) designing and planning work involved and commissioning the necessary equipment and workforce;
(c) selecting, loading, transporting and unloading scaffolding parts;
(d) erecting scaffolding structures;
(e) inspecting, monitoring, maintaining and modifying structures;
(f) dismantling structures;
(g) removing and disposing of structures and waste;
(h) evaluating work undertaken (optional);
(i) concurrent with the above, and particularly in relation to (c) and (d), is an inspection, which is often carried out by a senior scaffolder with a specialist qualification.

These nine functions are often divided among different kinds of scaffolders with different levels of knowledge, know-how, authority and responsibility, reflecting their preparation for their respective roles. A prospective scaffolder, prepared to take on most of the activities described in the cycle, needs extensive and systematic preparation. The complexity and dangers of scaffolding work make considerable training-centre-based, work-based and classroom-based learning and consolidation essential. The dependence of scaffolders on equipment requires that they learn about measurement, tolerances, properties of materials, and soil and weather conditions, and about technological advances. In addition, there are social implications that impact on their work, in particular the wellbeing of scaffolding users and clients, and the wider public. Consequently, a degree of theoretical education, tightly integrated with workplace operations, is indispensable in developing scaffolders who can work competently and safely while at the same time attending to their welfare, that of their colleagues and clients, and the wider public.

Not surprisingly, there are different approaches both to scaffolding and to scaffolding VET across Europe, including integration into other construction occupations (Poland), training courses leading to certification for different hierarchical levels (the Netherlands), modular-based continuing vocational education and training (CVET) (Belgium), a modular-based apprenticeship combining initial vocational education and training (IVET) and CVET and leading to a scaffolding qualification (Denmark), apprenticeship (Ireland) and dual-system apprenticeship (Germany).

Although an occupational profile for construction scaffolding has been developed through the European Skills, Competences, Qualifications and Occupations (ESCO) classification, intended to promote European labour market mobility by providing a standard classificatory approach to skills, competences and occupations, there is no evidence that this has played any role in the development of VET standards for scaffolding (ESCO, 2025).

This article presents the features and lessons learned from the recent adoption in Ireland, comple-

mented by those of the more established programmes of Denmark and Germany, to offer examples to other countries considering expanding their apprenticeship provision to include scaffolding.

9.1.2. **Apprenticeship**

It is helpful to explain what we mean by 'apprenticeship' so that the reader is not led astray by the ambiguity of some definitions and the wide variation in attempts to define the term. We aim to make our account broad but also capable of demarcating a distinct range of VET practices.

Apprenticeship is an IVET type of programme focused on the workplace to the extent that apprentices are employees with a special type of employment contract that takes account of their status as both learners and workers. Apprenticeship is understood to require a significant degree of preparation outside the operational conditions of the workplace, including in the classroom and through workshop activities and simulation. To reflect the degree of knowledge, skill, autonomy and responsibility that a competent scaffolder needs to exercise, the programme has an education rating at European qualifications framework (EQF) level 3 or 4, equivalent to an upper secondary programme ([47]). VET programmes, when completed and assessed successfully, result in a qualification that has labour market and educational value and can be used in an occupational labour market.

Apprentices do not need to be young people undertaking the transition between school and the labour market, although such young people constitute the bulk of apprentices in most countries. It is possible, and indeed quite common in some countries, for experienced construction workers or even adults from outside the sector to be able to undertake an apprenticeship programme in this sense. Apprenticeship is nevertheless distinguished from college-based routes in which workplace learning is undertaken as a student rather than an employee.

Our informal definition of apprenticeship corresponds closely to the 14 criteria for an apprenticeship of the European framework for quality and effective apprenticeships (EFQEA) (European Commission, 2017). However, as is also the case with the English standards-based apprenticeships, we do not specify that apprenticeships be set out in terms of learning outcomes (EFQEA learning and working conditions criterion 2) (Winch et al 2024). We also make it clear that apprenticeships should be at least at the upper secondary level (EQF level 3 or 4), thus excluding potential lower-level candidates under the EFQEA. In addition, we do not include some of the pay and working conditions criteria of the EFQEA, although these are desirable in any EU-recognised apprenticeship programme.

9.1.3. **Methodology and approach**

The Scaffold project sought to examine the state of the scaffolding sector across the six European countries in terms of four dimensions: employment and working conditions; VET and OSH training; technological developments and standardisation; and social dialogue structures. The project's methodological approach consisted of:

(a) producing national reports by social partner organisations in each participating country (EFBWW, 2024a);
(b) evaluating national reports by project evaluators;
(c) visiting scaffolding training centres and firms in Denmark, Germany and the United Kingdom;
(d) conducting steering group meetings and workshops;
(e) analysing and discussing findings among partners, evaluators, coordinators and other stakeholders in workshops dedicated to each of the four project dimensions;
(f) producing a final report by project evaluators and coordinators (Durán-Palma et al., 2024);
(g) proposing policy recommendations, in 11 languages, drawn up by social partner organisations (EFBWW, 2024b).

([47]) The English scaffolder qualification is based at level 2 of the national qualifications framework and, in terms of duration, knowledge required and degree of responsibility exercised, could not be considered equivalent to EQF level 3 or 4. It is therefore not considered an apprenticeship in our sense.

Recommendations included consideration of Erasmus+ programmes for scaffolding apprentices (Box 12) and aspects related to apprenticeships.

Box 12. **Scaffold project policy recommendations for Erasmus+ for apprentices**

Bearing in mind that experiencing other work environments and acquiring previously unknown techniques upgrades one's level of skills and knowledge, we recommend that the EFBWW fosters and supports Erasmus+ action for apprentices.
We recommend that the European Commission provides more tailor-made information and supports material in all EU languages for potential users of Erasmus+ for apprentices. Smaller firms in particular need easy access to programmes and support in the application procedures. Furthermore, it is recommended that the European Education and Culture Executive Agency provides detailed data on the use of programmes of Erasmus+ for apprentices on a yearly basis. Erasmus+ for apprentices must be better equipped financially and with corresponding staff at the agency.
Since Erasmus+ can only work if social partners, companies and training centres work closely together, we recommend that the European social partners promote the more frequent use of the Erasmus+ programmes and encourage increased mobility for apprenticeships and cross-border cooperation. This mobility and cooperation should also apply to the scaffolding sector.
We recommend that the EFBWW supports national social partners in Erasmus+. The social partners can participate, for instance, by creating information points for companies and apprentices, thereby supporting the dissemination of information material and guidance on the use of Erasmus+. It is recommended that the responsible national or regional authorities, in collaboration with the social partners, create platforms for training providers and companies engaged in the support of Erasmus+ actions. In addition, we recommend that companies engage in Erasmus+ programmes and offer international experiences to students and/or their employees and welcome students and/or employees from other countries in their premises, thereby improving workers' skills and the attractiveness of the industry.

Source: EFBWW, 2024b.

Participating stakeholders included the EFBWW and its national member associations, the scientific community, paritarian organisations in the scaffolding sector and a national employers' association, all of which were directly represented in the project, and the employers' associations – the European Construction Industry Federation (FIEC) and the Union of European Scaffolding Companies (Union Europäischer Gerüstbaubetriebe – UEG) – which actively supported the project as observers.

This approach offered numerous benefits, particularly in enhancing understanding of similarities and differences across national contexts, including visually, and encouraging critical reflection; it also presented some challenges, including conceptual equivalence, data availability through translation and interdisciplinary collaboration. Partly due to these challenges, the national reports underpinning the final report exhibit considerable variation. Some national teams relied exclusively on desk research, while others employed interviews and surveys to collect primary data. The national reports also vary in tone, with some more academic and others less so, some lengthy and others concise. This unevenness should be viewed not as a weakness but as reflecting the diversity of approaches and insights each team contributed.

9.2. Findings

There are considerable differences between the countries we investigated as to whether scaffolding VET is confined to IVET or to CVET or involves a mixture of both, and whether it takes the form of apprenticeships or just certification, involving particular modules or a complete course. Thus, of our six countries, Denmark, Germany and Ireland stand out in terms of having apprenticeship schemes for scaffolders, while Belgium and the Netherlands rely on certification; in Poland, scaffolding training is

incorporated in that of other construction occupations. Where Germany also stands out is in having the career structure associated with other construction *Berufe*, with the possibility of becoming a Meister after a three-year apprenticeship plus five years of work experience, involving a CVET course of eight months full time, plus passing an exam.

9.2.1. **Ireland**

Until 2021, the CSCS certification – involving basic (7-day) and advanced (10-day) off-the-job training and assessment programmes – was the main pathway to becoming a qualified scaffolder in Ireland. While the CSCS for basic scaffolders, or an equivalent training programme accredited by the Irish Further Education and Training Authority (SOLAS), remains the minimum acceptable standard of scaffolding training, the National Scaffolding Apprenticeship Consortium – led by the Construction Industry Federation and consisting of training providers, unions and employers – argues that such basic training:

… does not sufficiently equip people with (the) knowledge/awareness (necessary to operate in) a safety-critical trade (where) each individual working in the sector must be aware of their responsibility to themselves, those they are working with, the end user of the scaffold and also others who they may come into contact with while carrying out their role e.g. other trades, clients, members of the public.
(NSAC, 2020).

The consortium decided that a well-structured and comprehensive VET programme is required and, to this end, chose the apprenticeship pathway because it offers important benefits compared with alternatives, such as traineeship. While the latter offers the trainee a combination of workplace learning and formal training, the consortium agreed that the typical duration of traineeships (maximum 20 months, but usually not exceeding one year) is insufficient to allow trainees to gain the required competences and would not attract the same buy-in from the industry. More importantly, it was argued that, while the development of a traineeship is usually in response to a skills deficit, developing an apprenticeship presented an opportunity to place a comprehensive and consistent formal structure on an occupation that underpins the entire health and safety of the construction sector (NSAC, 2020). This structure would also afford the scaffolder, classified as a general operative despite the importance of the role, parity of status on-site with a skilled craftsperson, and 'help the sector to regain confidence in their workforce and significantly reduce health and safety risks' (NSAC, 2020).

In Ireland, the national apprenticeship system is governed by legislation, principally the 1967 Industrial Training Act, which sets out the overall structure and protections for and responsibilities of apprentices, employers and VET providers. Apprenticeship is defined as a structured VET programme formally combining and alternating learning in the workplace with learning in an education or training centre, leading to awards at EQF levels 2–5 (national framework of qualifications (NFQ) levels 3–6), with some higher apprenticeships at EQF level 6 (NFQ level 7 or 8). The state agency responsible for external quality assurance is Quality and Qualifications Ireland, which validates programmes, make awards and is responsible for the promotion, maintenance, development and review of the NFQ. The 2012 Qualifications and Quality Assurance Act also underpins apprenticeship, supporting national validation and quality assurance arrangements for programmes. The main VET providers are 16 education and training boards, while SOLAS is the government agency responsible for funding, planning and coordinating VET, including maintenance of registers of approved employers and of apprentices (Cedefop, 2021). The National Apprenticeship Council is responsible for overseeing and implementing the consortia-led construction apprenticeship programme, which includes scaffolding.

Although Ireland has adopted the ESCO pillar as reflecting labour market conditions, there is no evidence of an influence of the ESCO construction scaffolder occupational profile on the Irish scaffolder occupational profile (Mottweiler & Annen, 2025). This is hardly surprising as the ESCO descriptions are based on an aggregative model of assembling occupations by simply adding 'skills', failing to refer to the scaffolding cycle, the holistic and integrated nature of scaffolding work and the autonomy of the

scaffolder, and tending rather to adopt a 'lowest common denominator' approach, falling below national standards (Mottweiler, 2020).

The Irish scaffolding apprenticeship is a two-year structured programme of education and training that combines on-the-job employer-based training (80 %), with a SOLAS-approved employer, and off-the-job training delivered by Laois and Offaly Education and Training Board at the National Construction Training Campus (in the purpose-built scaffolding apprenticeship building) (20 %). The programme aims to provide the apprentice with the knowledge, skills and competence to perform safely and effectively as a scaffolder, in addition to providing a qualification that is academically robust and vocationally relevant. The apprentice is assigned a mentor by the employer for the on-the-job phases of the apprenticeship and an authorised officer from SOLAS, who monitors the apprentice during their apprenticeship. The off-the-job phases of the apprenticeship are delivered in eight modules over the two years: basic scaffolding principles; developing the scaffolder (personally and professionally); industry skills for scaffolders; scaffolding erection and dismantling; scaffolding compliance; management and control of scaffolding; complex structures; and capstone. On completion, participants become fully qualified scaffolders, with a Quality and Qualifications Ireland level 5 certificate in scaffolding.

The first apprentices graduated from this programme in late 2023. As of 2025, there have been 134 registrations, although some individuals withdrew their applications before beginning the off-the-job phase. Moreover, 45 apprentices have graduated, 34 are at various stages of completion and 11 are on a waiting list. Of the remaining 23, some have left the scaffolding industry and others have paused their programme with an option to return in the future. While Ireland currently operates a dual system for the training and assessment of scaffolders, it is envisaged that the scaffolding apprenticeship will replace the CSCS pathway in whole or in part at some stage. Delivering scaffolding training through a recognised level 5 apprenticeship model is an important step forward and means that there is an accredited qualification for those working in this area, thus helping with their career progression paths.

9.2.2. **Germany**

Germany has the most comprehensive apprenticeship system for scaffolding, stretching over three years and divided between the classroom, intercompany workshops and site-based practical work in the firm, involving:

(a) 13 weeks each year or a total of 39 weeks in the classroom;
(b) 10 weeks in the first and second years and 5 weeks in the third year in intercompany workshops, totalling 25 weeks or 20 % of the time;
(c) 20 weeks per year in the firm, totalling 60 weeks.

Scaffolding apprenticeship is part of the dual system, divided between state and industry, and thus leads to a vocational qualification recognised throughout the entire national system of education and employment. Its status as a recognised vocational qualification is important for classification according to collective agreements and when applying for a job. The qualification is also necessary for admission to further education and training, for example for the *Meister* examination and courses preparing for this, and, under certain circumstances, higher education studies. In scaffolding, more than half of the apprentices are at least 18 years old at the start of their programme, with 1 in 6 over 24 years. In addition, most of the apprentices have a certificate from a lower secondary school and only a few are women.

As with the other construction *Berufe*, part of the practical training for scaffolding takes place in intercompany training centres, which play an important role as many small companies cannot cover the entire breadth of the occupation's activities and do not always have the wide range of modern technical equipment needed. The training centres, of which there are three across Germany for scaffolding, are paid for by a training levy of 2.1 % of companies' gross wage bill and are at the cutting edge of technical and vocational pedagogical development.

Detailed data on apprentice numbers over time are published regularly by the Federal Institute for

Vocational Education and Training (Bundesinstitut für Berufsbildung (BIBB)) and such data on the participation of companies of different sizes in apprenticeships are published by SOKA-Gerüstbau (the social fund for scaffolding). According to the SOKA-Gerüstbau data, there were 919 trainees in 2022, over all three training years, while BIBB data indicate that, of all trainees in 2021, 16 % were of non-German nationality, just under 14 % had not completed lower secondary school and 9 % had a higher education entrance qualification (Syben, 2023). Very small companies, with fewer than 10 employees, accounted for more than half of all companies participating in 2022 (56 %), although they offer fewer than 22 % of training places, while large firms, with 50 or more employees and comprising only 2 % of all firms, account for about 20 % of all training places. The number of apprentices who successfully complete the programme is, however, considerably lower than the number of those who start it, with completers fluctuating between 150 and 200 per year up to 2021, while around two thirds of the apprentices passed their exams.

A general problem with apprenticeships for scaffolding is the premature termination of contracts, affecting up to half of all contracts over the last five years and representing a vocational pedagogical challenge. This reflects a general problem for VET in a sector where most companies are small, even micro, and thus do not necessarily have the capacity, mentoring ability or portfolio of future contracts to commit to taking on apprentices for up to three years.

Apprenticeship content covers the entire range of work required in the scaffolding construction cycle, including preparatory surveying work, setting up a construction site and assessing load-bearing foundations; establishing the load-bearing capacity, the materials to be used and the various common work processes and work techniques; and the handling and maintenance of tools, equipment, machines and technical facilities required for this. The following specific topics are addressed:

(a) maintenance, storage and transport of scaffolding components;
(b) anchoring of scaffolding;
(c) construction of length- and area-oriented working and protective scaffolds;
(d) construction of shoring with substructure including the basic formwork;
(e) knowledge and use of working platforms and lifts;
(f) construction of suspended scaffolding;
(g) construction of weather-protection halls and enclosures;
(h) construction of scaffolding for special requirements.

Furthermore, quality assurance measures and reporting are part of the programme, as are OSH measures and environmental protection, all of which must be realised when executing the practical examination task at the end of the third year. Knowledge acquisition has been facilitated by standardising the scaffolding of all manufacturers so that workers do not have to deal with the peculiarities of different scaffolding systems.

9.2.3. **Denmark**

IVET and CVET merge in Denmark's two-year industry apprenticeship programme – dating back to 2009 and obligatory for all scaffolders after three months or less of employment – on an alternating basis. Apprenticeships take place off-site in classrooms or workshops and on-site, on a full salary (with a state subsidy available), with different modules totalling 25 weeks or 120 days, and in accordance with the collective agreement. Apprentices gain a truck-driving licence and crane and forklift certificates, while additional training is available for offshore work. The programme provides insight into the working environment and consists of several OSH training programmes, which must be completed before workers are allowed to perform work that can pose a significant accident risk or health hazard. Once the apprentice has completed all courses, a final examination is held, which results in qualification as a scaffolder. These requirements for the educational elements also apply to workers coming from outside Denmark, who must meet them to have their competences in scaffolding assembly recognised to work in the sector.

A survey conducted in 2019 to identify scaffolding workers in the sector showed that around 51 % of participants had completed the entire two-year scaffolder training programme, while around 27 %, including apprentices, had undertaken individual scaffolding modules. The programme covers system scaffolding, pipe and coupling scaffolding, setting up special scaffolding, enclosure and total enclosure scaffolding, and coordinated scaffolding assembly. Furthermore, it is mandatory to obtain the necessary licences to drive forklifts, to work with cranes and to comply with the safety requirements for working on roads. In addition to scaffolding knowledge, general skills such as customer service, cooperation and understanding drawings are acquired.

The 2023 collective agreement has a provision for training and upskilling if work is stopped, for instance due to bad weather. It also creates an incentive to include apprentices in the pricing of on-the-job training, consisting of trained scaffolders receiving a so-called mentor supplement for taking on apprentices. This is intended to motivate more scaffolders to take on apprentices, retain apprentices in training and obtain more trained scaffolders; it is also intended to strengthen the sector in the long term. The parties in the scaffolding sector work together to ensure retention but the average scaffolder stays for only 11 years. Those who stay tend to have completed the programme, but many leave the industry; there is a high turnover rate. The programme is continuously being modernised to adapt to developments, including new materials, technological developments, health and safety requirements, etc.

9.3. Conclusions

Broadly speaking, the research revealed that training resulting only in certification goes together with a degree of fragmentation of the work process and multiple levels of hierarchy within the overall occupation, while at the same time reflecting the amount and quality of VET required to undertake different aspects of scaffolding work. In contrast, extensive and comprehensive VET leading to a scaffolding qualification, as found in the apprenticeship-based programmes in Germany and Ireland, implies a relatively autonomous workforce, able to undertake most of the activities involved in the scaffolding cycle. ESCO does not provide a good model for the development of apprenticeships along these lines, although it could arguably accommodate the EFQEA criteria.

The apprenticeship systems for scaffolding developed in the three countries – Denmark, Germany and Ireland – differ in terms of when they were established and their comprehensiveness. The German system has been in place for the longest period, while the Irish system has only very recently been introduced. The German apprenticeship is also the most wide-ranging, lasting three years and with the possibility of progressing to *Meister* level. However, the fact that the number of apprentices completing the programme is considerably lower than the number who start it, that one third do not then pass the final examination and that up to half of all apprenticeship contracts are prematurely terminated points to considerable problems with maintaining high-quality apprenticeships. Such problems are evident too from the demise of the scaffolding apprenticeship in the Netherlands.

A key problem with apprenticeship is that it requires a stable labour market to provide the infrastructure for the work-based element, and the construction labour market across Europe is often unstable, beset by casual employment and self-employment, long subcontracting chains and a lack of regulation, including of posted and migrant workers. Small firms and microfirms constitute the vast majority of scaffolding firms, many without the capacity or portfolio of future work to consider employing apprentices, while the large firms subcontract much of their work and the medium-sized firms – widely recognised as the key to maintaining a successful apprenticeship system for construction in Germany – are dwindling in number. It is therefore no coincidence in the Dutch case that apprenticeship has been abandoned given that 55 % of the 1 250 scaffolding employees are self-employed, with migrant scaffolders dominating temporary jobs.

If scaffolding VET and direct employment are not mandatory for working in the scaffolding sector,

or are obligatory only in terms of certification following a minimum level of training, the danger is of a two-tier labour market, with one tier fully qualified through apprenticeships for all aspects of scaffolding work and the other just meeting the minimum requirements for safe working, as is possible in the Irish case. This danger is also evident in the German case, where, in contrast to Denmark and Ireland, there is no obligation to be certified. In this respect, the Danish system, mandatory for all, including the migrant workforce, and providing VET for all aspects of scaffolding work, including a truck driving licence and crane and forklift certificates, serves as a model. Here, however, the construction labour market is more stable, given high levels of unionisation (94 %) and regulation through the collective agreement.

In other respects, the German scaffolding apprenticeship stands out for its comprehensiveness, covering the knowledge (e.g. physics), know-how or skills, and competences (e.g. communication) involved in the scaffolding cycle, including the selection, erection, repair, maintenance, modification, dismantling and transport of the physical components of scaffolding, involving measuring, testing, fastening, hoisting, unloading, etc. Above all, due to the complexity of this cycle and the necessity of teamwork, the apprenticeship is concerned with developing project management abilities. This means that apprentices learn to plan, design and work out the scaffolding structure and the materials and workforce needed to create it. They also learn to control and coordinate work so that activities take place in sequence, materials and workers are in place at the appropriate times, and information, questions and orders are delivered and understood in a timely and accurate manner. Finally, they learn to cooperate and to solve the many problems that can arise, including those concerning health and safety, changes in client specifications, and the vagaries of weather and ground conditions.

Although shorter, the new Irish scaffolding apprenticeship also promises to develop all these abilities. Most importantly, the Irish example highlights the role that apprenticeship can play in terms of the status of scaffolders, in according public recognition as a skilled occupation and in offering permeability for further career progression, whether to higher education or to supervisory and management positions. As outlined in Box 12, undertaking an apprenticeship also facilitates involvement in Erasmus+ programmes that provide experience of scaffolding across Europe.

All these considerations demonstrate the need for high-quality apprenticeships for scaffolding – including both practical and theoretical components – and the importance of the scaffolder to ensuring the safety of the entire building process, even though, on completion, their work is no longer visible. The above considerations are applicable to all EU Member States, as are the policy recommendations drawn up by the Scaffold project partners for discussion by the construction social partners through social dialogue, as summarised in Box 13.

Box 13. **Scaffold project-relevant policy recommendations**

VET

Based on mandatory VET structures for scaffolders at the national level, it is recommended that requirements regarding the minimum duration of VET be developed and introduced at the national level, both occupationally and in terms of the working environment. Practical and theoretical education and training should be an integral part of scaffolding education. The qualification should be as broad as possible, dealing with all aspects of scaffolding and the various forms of scaffolds.

OSH training

OSH training for scaffolders, supervisors and scaffold users must be mandatory. Mandatory VET for scaffolders should be considered mandatory on-the-job training, with associated off-the-job training in schools, colleges and/or training centres, and regular further training. How it is designed depends on the national framework provided by the VET system and OSH regulations. It is desirable and possible to develop European OSH recommendations/guidance for scaffolders and scaffolding users on OSH training in the EU Member States, to include theoretical and practical elements, while improving and strengthening the working environment and safety.

Collective agreements and forms of employment

There is a need to ensure proper and secure terms of employment for scaffolders. It is recommended that employment terms for scaffolders be eliminated in forms other than permanent employment contracts. This can be accompanied by incentives for companies providing permanent employment and high-level training opportunities. Employment, training and certification, and qualification, requirements must be in place for all those involved in the scaffolding work process, including national requirements for the performance of the work before it is carried out.

Cross-border work and services

It is necessary for Member States to introduce guidelines, establish a process and set up an authority for the assessment, recognition and confirmation of certificates and qualification levels of scaffolders from countries other than the host country. Recognition and confirmation of certificates and qualification levels, and documentation of their authenticity, must be in place before the scaffolding work begins.

Companies providing cross-border services in the sector often do not act in accordance with OSH provisions; nor are the workers properly trained regarding host country OSH regulations. It is recommended that a certification process for sending countries is established, to prove that scaffolders can follow the health and safety provisions in the host country and are properly employed and trained accordingly.

It is necessary to ensure that information about the relevant Member State's regulations, including requirements for the performance of the work, and training certificate and qualification requirements, is provided in such a way and language as to be understandable for all workers.

It is necessary for the individual Member States to develop further training structures aimed at scaffolding workers from countries other than the host country so that the host country's requirements for certificates and qualifications can be met. Unions should support political initiatives to create a voluntary system of mutual recognition of certificates issued by Member States.

Source: EFBWW, 2024b.

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CHAPTER 10.

Enhancing skill governance through apprenticeship in the wine sector: the case of Tuscany's wine technician dual pathway

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10.1. Introduction: the wine sector in Italy and Tuscany

This paper draws from a research project designed by the regional authority of Tuscany (Tuscany Region) and the National Institute for Public Policy Analysis (INAPP) , within the framework of the German–Italian bilateral project ConnActions, launched in 2023 and involving collaboration between the governments of the two countries. Aiming to reinforce dual vocational education and training (VET) to support skills anticipation, through stable and multistakeholder networks and with a bottom-up approach, the project established six bilateral networks, each targeting different areas. Among these is the wine network, which involves key policy actors of three representative regions of the European wine industry across the two countries: Tuscany, the Autonomous Province of Trento and Rhineland-Palatinate. Being finalised in 2025, the main research analyses the German and Italian regional skills ecosystems in the wine sector in the abovementioned territories, investigating the underlying governance of skills dynamics and identifying the enabling factors supporting better skills anticipation across the ecosystems.

This research paper presents an initial primary investigation analysis focused on the Italian side, taking into consideration only the territory of Tuscany, and particularly the Siena area, where the local skills ecosystem has been strengthened through a new apprenticeship programme, engaging companies, associations of professionals and temporary employment agencies. The focus of the current paper is to explain how the introduction of an apprenticeship experience in the field can help in shaping and supporting the creation or the revival of a local/regional skills ecosystem.

10.1.1. **The wine sector in Italy**

The wine sector is strategic for Italy, the leading producer country and the second largest exporter worldwide, in a globalised and highly competitive market situation. It boasts a very rich heritage of knowledge and know-how spread across the territories. Italy is a worldwide player in wine production, together with France, reaching in 2022 a production of 48.5 million hectolitres ([50]), with a slight decrease in 2023 (38 million hectolitres) and a significant increase in the estimation of the 2024 production ([51]). Data clearly show the significance of the share of wine production and export in Italian gross domestic product (over 1 %), with the industry involving more than 300 000 workers. The 255 000 vineyard farming firms and

([48]) Tuscany Region (miriana.bucalossi@regione.toscana.it).
([49]) National Institute for Public Policy Analysis (INAPP), Italy.
([50]) Data from the Institute of Services for the Agricultural Food Market monitoring of the wine sector.
([51]) Production and volumes are of high quality, as 30 % of total national production of wine is represented by controlled and guaranteed designation of origin (*Denominazione di Origine Controllata e Garantita* (DOCG)) and controlled designation of origin (*Denominazione di Origine Controllata* (DOC)) labels.

wineries of this sector represent 23 % of the agriculture firms in Italy, with important territorial differences. The sector faces several difficulties linked to epochal challenges such as climate change ([52]), and since 2020 both the effects of the COVID-19 pandemic and a series of unpredictable changing scenarios that are elevating the complexity of the reference markets. While the geographical indication of wines assures quality and tells the identity of territories, the rigidity of the system of geographical indication is also an obstacle in the general integration of instruments, policies and strategies (Tscholl et al., 2024).

10.1.2. **The wine sector in Tuscany**

The Tuscan wine sector represents one of the most significant and distinctive realities in both the Italian wine landscape and the global wine landscape (ISMEA, 2022). With over 12 700 wine-producing companies and a vineyard area approaching 60 000 hectares, Tuscany is one of the leading wine-producing regions, with a structure characterised by small family-run businesses. The average vineyard area per company is around 4.7 hectares, highlighting the prevalence of small producers compared with other viticultural regions in Europe. Despite its fragmented structure, the sector has managed to remain highly competitive, based on quality, territorial identity and innovation. Sustainability is a central theme in the sector, contributing to the exponential growth in organic viticulture in Tuscany.

Box 14. **Distinguishing features of Tuscany's wine landscape**

A distinguishing feature of Tuscany's wine landscape is the dominance of Sangiovese, a variety that covers about 60 % of the region's vineyard area. This grape, symbolic of Tuscany, forms the basis of some of the most prestigious protected designations of origin, such as Chianti, Brunello di Montalcino and Vino Nobile di Montepulciano. The region's ability to enhance local peculiarities while maintaining a strong focus on quality is a key element that has allowed Tuscany to gain global recognition. Another distinguishing aspect of Tuscan viticulture is the presence of a significant number of recognised geographical indications: there are 58 recognised geographical indications, of which 52 are 'denomination of protected origin' (DOP) and 6 are 'protected geographical indication' (IGT), covering about 96.4 % of the regional vineyard area, far above the national average. These designations are the cornerstone of the region's success, helping to consolidate the image of Tuscany as a land dedicated to quality and diversity.

Source: The authors.

Exports are a fundamental pillar of Tuscany's wine economy. The region accounts for approximately 5 % of national wine production, with an important commitment to the quality of the products it exports.

Despite its successes, Tuscany's wine sector faces several challenges, such as the fragmentation of businesses. While leading to a wide variety of products, fragmentation can be an obstacle to innovation and achieving economies of scale, especially in a highly competitive global market. Climatic difficulties, such as spring frosts and summer droughts, continue to impact production, as seen in recent harvests, with an overall decrease in wine production of – 1.4 % in 2024 compared with the previous year. Rising raw material costs and inflation, exacerbated by the global geopolitical context, may present additional obstacles to growth.

Nonetheless, Tuscan viticulture represents a model of excellence, combining tradition and innovation in an ever-evolving context, providing proof of resilience in maintaining strong competitiveness in the global market and consolidating its position as one of the leading wine regions in the world.

10.1.3. **Professions in the Italian wine sector**

Coldiretti statistical data reveal highly interesting employment rates in the various fields of the wine sector (harvesting, production, promotion, marketing and distribution). This sector has grown exponentially in

([52]) During the 2024 G7 agriculture ministers' meeting, a joint declaration of the agriculture ministries was adopted, emphasising the need for resilience and sustainable agriculture in the future.

recent years, boosting the wine tourism industry to the extent of prompting specific legislation on wine tourism ([53]). Wine tourism refers to activities focused on wine education carried out at production sites and visits to vineyards, production facilities or exhibitions of viticulture tools, including wine tasting and commercialisation of the companies' wine products, sometimes combined with local food tasting, educational or recreational initiatives within wineries and local food fairs.

After several reforms, nowadays the historical professional profile of wine technician specialises in vine cultivation, harvesting and bottling techniques learned during viticulture and oenology training, as outlined in Presidential Decree No 88/2010.

Graduates of five-year upper secondary school programmes from agricultural schools with a viticulture/oenology subject can earn the higher VET qualification of 'wine technician' through an additional year of study (European qualifications framework (EQF) level 5). This high specialisation path offers the knowledge, skills and competences necessary for employment in companies related to the wine sector.

Box 15 . **Key competences of wine technicians**

- Organising eco-friendly viticulture activities.
- Managing production and transformation processes while ensuring product traceability and safety.
- Addressing production challenges specific to local territories.
- Applying national and EU wine legislation, including food safety regulations.
- Utilising appropriate tools and methods for product verification and control.
- Overseeing the winemaking process at all stages with an emphasis on innovative technologies.
- Conducting economic assessments of production and transformation processes.
- Promoting wine products tied to territorial characteristics.

Source: The authors.

Graduates are qualified to manage wine production processes across the value chain and are eligible for membership of the National Association of Technicians in the Wine Sector (Associazione Enologi Enotecnici Italiani (Assoenologi)), the national professional association of oenologists and wine technicians.

Box 16. **The National Association of Technicians in the Wine Sector (Assoenologi)**

Assoenologi is the most representative professional association of wine technicians in Italy. Today, it represents nearly 4 500 professionals, about 85 % of the active technicians in the wine sector, ensuring their representation, protection and ongoing technical and scientific training.
Since 2006, it has represented the technicians' professional needs within the National Wine Board. Since 2019, it has been listed in the Register of Professional Associations with the Ministry of Economic Development (Law No 4/2013) and therefore is responsible for and guarantees the quality of professional services provided by its members, with the task of enhancing their skills and ensuring adherence to ethical guidelines.

Source: Assoenologi.

Traditionally, training in the sector has been delivered almost entirely in school settings, with practical experience being gained through *alternance* (work–study) training and internships, limited to a maximum of 30 % of the total duration. While the curriculum is standardised at the national level, it allows for adaptation to regional agro-industrial specificities. Practical training is crucial for wine technicians, including work–study programmes and schemes that are scheduled throughout the year. Internships

([53]) The ecosystem logic is present in the Ministry of Agriculture decree outlining national guidelines on quality standards and essential requirements for wine tourism activities. Based on these standards, Tuscany adopted Regional Law No 76/2019.

during critical production and winemaking periods, seminars with industry experts and guided visits to vineyards and wineries are constant activities in this kind of learning, with the same programmes being delivered across the country, but with particularities due to territorial differences. Wine technicians play a key role in managing grape and wine supply chains, with direct access to the labour market.

Box 17. **Other professional profiles in the wine sector**

The profession of **oenologist** is regulated by Law No 129 of 10 April 1991 on the regulation of the profession of oenologist (among the 'food product technicians' within the health and life sciences sector). An oenologist manages, coordinates and supervises the various stages of the winemaking process, from viticulture to bottling and commercialisation, ensuring compliance with Law No 238/2016 on the Organic Regulation of Vine Cultivation and Wine Production and Trade ('Consolidated Wine Law'). The primary responsibility of the oenologist is to ensure that wine production is safe and compliant in terms of physical, chemical, organoleptic and legal standards. To become an oenologist, a bachelor degree (EQF level 7) in the wine sector is required. The educational path bridges various degree classes from the agricultural sector to food science and technology.

The **sommelier** is the expert in the selection and service of wines, capable of evaluating the organoleptic profile, characteristics and conservation potential of drinks, especially in terms of advising customers on the right wine to pair with dishes. This requires a deep knowledge of the main wine-growing regions (oenography), the main regulations related to wine production, the history of wine, cultivation and oenological techniques, and vines (ampelography). The specialty of sommelier is highly sought after in the food and beverage sector. The qualification of professional sommelier is obtained by attending courses of officially recognised sommelier associations, such as the Italian Sommelier Association, the Italian Federation of Sommeliers, Hoteliers and Restaurateurs, and the National Organisation of Wine Tasters.

Other professional profiles contribute to the wine sector and are listed in regional or national qualification registries. These include **cellar worker** (individuals can qualify through a VET qualification in wineries, overseeing grape-to-wine transformation, from crushing to fermentation), **brand ambassador** (responsible for product communication and sales) and **wine blogger** (experts in wineries and wine shops who use blogs and social media to provide advice and suggestions).

Source: The authors.

10.2. Research methodology: wine districts as social skills ecosystems

Over the centuries, the Italian vineyard and wine production sector has accumulated a rich knowledge that is today represented by strategic know-how, which is extremely diffused at the territorial level. However, this know-how is currently much impacted by ongoing trends and transitions:

(a) sustainability and the need to mitigate climate change;
(b) negative demographic trends that might have a disruptive effect in traditional sectors such as agriculture and wine production;
(c) the impact of artificial intelligence, although this is more limited.

Having the right set of competences in the wine industry is considered essential for maintaining vibrant wine districts. Education and the technical and vocational training pathways need to stay tuned to the new challenges and trends mentioned above, assuring:

(a) more effective and more inclusive training investments to support territories with the ongoing changes (Barca, 2009);

(b) resilience strategies for facing market turbulence (national and international), including through skills anticipation mechanisms (OECD, 2020; Brynjolfsson & McAfee, 2014);
(c) effective learning policies through structured and constant dialogue with enterprises and stakeholders (Lundvall, 1996; Etzkowitz & Leydesdorff, 2000; European Commission, 2020).

As a result, key policy actors acknowledge the need for structured school–work alternation schemes at the secondary and tertiary levels of education. Research and innovation activities, involving basic or applied research, have been launched with the aim of improving the resilience of firms and adaptation in line with the green transition. The national recovery and resilience plan places great importance on this drive for training, research and innovation, including in terms of available financial resources. Strengthening skills governance – including the development, activation and strategic reinforcement of skills – represents a critical lever for fostering the emergence of innovative ecosystems and strengthening the resilience of existing ones.

Wine districts can be conceived as 'skills ecosystems', specifically examined through the lens of competences. Finegold (1999) characterises skills ecosystems as social, regional or sectoral formations in which human capabilities are cultivated and applied for productive purposes. This analytical perspective provides a comprehensive framework for understanding the role of competences in shaping and sustaining wine districts as dynamic and adaptive systems. Ecosystems are communities capable of adapting, and the actors involved interact with one another and may perform different tasks, change and evolve. The fundamental elements characterising skills ecosystems are identifiable in the entrepreneurial context, the business models adopted, the institutional frameworks within which policymaking processes take place, the methods of worker recruitment, the structure of employment, the level of skills and systems for training (Buchanan et al., 2017).

Wine districts, while having certain features in common with industrial districts, diverge significantly due to their unique attributes, notably a horizontal specialisation that contrasts with the vertical specialisation typical of traditional industrial districts. This horizontal specialisation stems from the integration of diverse stakeholders across the value chain, encompassing viticulture, marketing and oenotourism. This interconnected structure facilitates collaboration across multiple domains, creating a dynamic and cohesive ecosystem.

De Marchi and Grandinetti (2016) further shed light on the evolving dynamics of Italian wine districts, situated within 'glocal' value chains where local interactions are increasingly shaped by global competitive pressures. Driven by the need for firms to effectively position themselves within global value chains, international entrepreneurship and the cultivation of local and global networks emerge as pivotal factors in ensuring the adaptability and long-term success of these districts. The concept of skills ecosystems aligns closely with this evolution, emphasising the importance of developing competences that enable firms to thrive in both local and global environments.

Spours (2019) developed an alternative ecosystem model to explore the relationship between disruptive economic and technological developments and their impact on local economies, jobs, urban environments and living conditions. Unlike the enterprise-focused model of Finegold (1999) and Buchanan et al. (2017), Spours's social ecosystem model emphasises the 'local community' as the centre of economic, civic and educational participation. This approach resulted in a dynamic, multilevel skills ecosystem where time and space are key factors in skills development. This social skills ecosystem is conceptualised as a dynamic system with four interconnected dimensions: integrating collaborative networks, supportive vertical structures, mediation and a long-term perspective anchored in 'ecological time', driving skills development and transformation.

Adapting Spours's social ecosystem model, Lotz-Sisitka (2020) emphasises the need for place-based leadership in social-ecosystemic skills planning to address problem contexts and foster inclusive, sustainable development. Similarly, Ramsarup et al. (2023) highlight the role of skills as enablers in the ecosystem, bridging vertical and horizontal dimensions to support a just transition. They underscore

the transformative potential of relational networks in integrating learning and work, advocating for systemic leadership at the ecosystem level. Ramsarup et al. further call for embedding concerns about just transition into skills development frameworks and propose an expanded model of the social skills ecosystem to address these challenges.

Building on this conceptual evolution, the viticulture ecosystem model (VEM) has been developed as an adaptation of the social ecosystem model to the context of wine-producing territories. Applied to the case of the Sienese wine district, the VEM provides an integrated analytical framework to examine how competences are developed, activated and governed within a territorially embedded and sector-specific ecosystem. The model is articulated around four interrelated dimensions (see also Sprout, 2019).

(a) **Horizontal collaboration.** This dimension captures the co-construction of training and skills development pathways among local actors, including educational institutions, enterprises and community stakeholders.
(b) **Facilitating verticality.** This dimension reflects the alignment between territorial practices and national or regional policies, ensuring coherence in funding, regulation and strategic direction.
(c) **Mediating policies.** This refers to governance and leadership mechanisms that promote systemic coordination, a shared vision and negotiated solutions among diverse ecosystem actors.
(d) **Ecological time.** This dimension stresses the need for long-term adaptability and continuous innovation, embedding monitoring and foresight into the planning of education and training to respond effectively to environmental, technological and socioeconomic transitions.

The VEM contributes to a better understanding of how wine districts can evolve as inclusive, resilient and innovation-driven skills ecosystems. It offers a framework to support the following analysis of the design, implementation and governance of the Tuscan wine technician programme.

10.3. Exploring the wine sector's local skills ecosystem

10.3.1. **Strengthening Tuscany's wine sector skills through apprenticeships**

As a strategic response to the growing imperative of aligning education and training pathways with labour market demands, in 2020 the local government of Tuscany launched an initiative to adapt the wine technician as a specialisation programme that follows the apprenticeship model at higher level (EQF level 5). This entailed a substantial restructuring of the conventional post-secondary specialisation pathway to incorporate the distinctive features of dual training, thus embedding it within the regulatory and pedagogical framework of apprenticeship.

This transformation was not driven by national regulatory mandates but rather emerged as a regionally initiated policy innovation. It leveraged the enabling provisions of Legislative Decree No 81/2015 on higher education and research apprenticeships, which extended the use of apprenticeship contracts to higher technical education. This opportunity has remained underutilised at the national level. Therefore, Tuscany's initiative stands out as a proactive approach to integrating apprenticeships into the broader skills governance strategy, particularly in sectors recognised as economically and culturally strategic.

The programme serves as an illustrative case of how apprenticeship can function not only as a training modality but also as a governance tool. It fosters shared responsibility between educational institutions and employers, facilitates the co-design of training content aligned with sectoral needs and contributes to the resilience and adaptability of the regional skills ecosystem.

Within this strategic framework, the implementation of the dual apprenticeship programme in the Siena area constitutes a particularly significant case study. Its relevance stems not only from the economic and cultural importance of viticulture in the territory but also from the involvement of a long-established oenological institution, which combines educational functions with a capacity for sectoral innovation.

The case of Siena offers valuable insights into how territorially embedded institutions can act as anchors for skills development and knowledge transfer in specialised sectors.

10.3.2. **From school-based training to apprenticeship**

The wine technician specialisation programme represents a nationally regulated, post-secondary programme classified at EQF level 5. It consists of an additional year of study beyond the five-year upper secondary diploma in agricultural education, with a specific focus on viticulture and oenology (see Section 10.1.3). The programme has a total workload of 1 056 hours and is offered by a limited number of institutions – currently around 20 schools across the country. It is designed to provide advanced technical competences in vineyard management, grape processing and winemaking operations.

The local government of Tuscany made a deliberate policy choice to apply the 50–50 % model (50% school-based instruction and 50% in-company training) to this qualification pathway, which was originally conceived as a school-based programme. Legislative Decree No 81/2015 allowed for such an equal distribution between in-company training and school-based instruction (although in practice the split is rarely equal). This strategic decision entailed not only the formal adaptation of the dual apprenticeship format but also the provision of targeted funding and implementation support to ensure its operational viability and coherence with regional skills priorities.

This policy was translated into practice through the introduction of a structured dual apprenticeship pathway, maintaining the same total duration (1 056 hours) but redistributing it equally between in-company training (50 %) and school-based instruction (50 %). Under this model, the enterprise becomes both the employer and co-trainer of the apprentice, working in close cooperation with the school. This configuration transforms the nature of the training relationship, positioning the company as a formal actor in the educational process.

The rationale of the intervention also addresses challenges observed in conventional school-to-work transition schemes. Although companies have historically valued the opportunity to host students through internships of shorter duration, learners have often left school early to gain immediate employment without completing the programmes and acquiring qualifications. The apprenticeship model addresses the need to earn while learning and becoming fully qualified.

The programme is implemented in agricultural technical institutes specialising in agriculture, agrifood and agro-industry, with a particular focus on viticulture and oenology. In Tuscany, it has been supported through annual calls for proposals launched by the region, which provide financial resources to schools for the design and delivery of the dual format. Initially funded through national apprenticeship schemes, the programme has been co-financed by the European Social Fund Plus (2021–2027) since 2021.

At the time of writing (June 2025), the programme was in its third edition at the Bettino Ricasoli Agricultural Technical Institute in Siena, a long-established institution with strong roots in the regional wine sector (Box 17). The pilot at the Bettino Ricasoli Institute was developed in collaboration with a network of local wine producers, representing a concrete example of systemic curriculum transformation, informed by the occupations and territorial specificities.

Since its launch in 2020, the programme has been delivered to a single class of apprentices per year. This is consistent with the selective nature of the wine technician specialisation programme, which is currently offered by only around 20 institutions nationwide. Between 2020 and 2024, a total of 53 apprentices and 36 companies took part in the dual pathway in Tuscany. While modest in numerical scale, these figures reflect the targeted scope of the intervention and its experimental character within the broader national training landscape.

Box 18. **Bettino Ricasoli Agricultural Technical Institute**

Founded in the 1940s, the Bettino Ricasoli Agricultural Technical Institute builds on Italy's long-standing tradition of oenological education. Located in the Chianti hills, a region renowned for its winemaking heritage, the institute has been

part of the national network of oenological schools since 1980. The school's 47-hectare campus includes 10 hectares of vineyards and 4.5 hectares of olive groves, orchards, greenhouses, vegetable gardens and woodlands, all designed with a focus on sustainability. It operates a teaching winery, offering students practical training in winemaking. The institute's approach integrates traditional methods with modern techniques, preparing students for careers in the agricultural and oenological sectors, with a strong emphasis on sustainable practices and environmental stewardship.

Source: The authors.

10.3.3. **Horizontal collaboration to co-shape the programme and support apprentices**

Regional support in Tuscany encompasses several key areas. Financial contributions are provided for the joint development of each apprentice's individual training plan, designed collaboratively by schools and employers. This process ensures that learning outcomes and training contexts are tailored to the specific operational requirements of each hosting company. Funding is also allocated to support school-based tutorship throughout the dual pathway. Apprentices receive personalised support in terms of skills activation, remediation and skills alignment. This support is in the form of targeted interventions designed to address potential gaps in theoretical or scientific knowledge that may affect apprentices' full participation in the programme. Since 2024, an additional funding stream has been made available to strengthen the programme's technical content, with a focus on climate adaptation and the green and digital transitions, in line with the Italian national recovery and resilience plan.

Topics addressed include precision viticulture, satellite-based georeferencing, smart farming technologies and the integration of mechanical and plant engineering in wine production processes. These supplementary training activities, introduced and supported by the local government of Tuscany, enrich the national curriculum and enable educational institutions to update the content of the programme in line with current sectoral needs. As the wine technician qualification was established in 2010 (through Presidential Decree No 88/2010), the integration of new modules related to climate adaptation, digitalisation and internationalisation allow for a timely revision of the original training standards. This contributes to ensuring that the programme remains aligned with the evolving innovation trajectories of the wine sector and the broader agrifood system.

Each apprentice is supported through a dedicated individual training plan, which includes information on the employer, the company tutor, the school-based tutor and the training institution, in addition to contractual elements such as the type of apprenticeship, the qualification, the duration and the job title, and a detailed outline of the training components delivered by both the school and the company, including duration and evaluation criteria. Schools and employers jointly monitor the apprentice's progress throughout the programme.

A key element in ensuring the coherence and quality of the dual training experience is the joint tutoring system, composed of a company tutor and a school-based tutor, both formally designated in the individual training plan. These individuals share responsibility for guiding and supervising the learning process and for facilitating the integration between school-based instruction and in-company training.

The school-based tutor, typically a teacher appointed by the educational institution, performs a role that goes beyond standard teaching duties. The tutor supports the apprentice in managing their relationship with the school, monitors the learning progress and takes part in the initial, intermediate and final evaluations. In this capacity, the school-based tutor ensures that the external training component is pedagogically coherent and aligned with the educational objectives of the qualification.

The company tutor is responsible for the apprentice's integration into the workplace, supervising task execution, providing on-the-job guidance and facilitating the acquisition of job-specific skills. The company tutor also works in close coordination with the school-based tutor, providing regular feedback on the apprentice's performance and on the effectiveness of work-based training.

Together, the two tutors are jointly responsible for compiling the apprentice's individual training dossier,

which documents the activities carried out and the competences acquired during the apprenticeship. This process also ensures that learning is formally recognised even in the event of early contract termination. The dual tutoring arrangement thus plays a pivotal role in bridging formal education and work-based learning, while also contributing to the validation and certification of acquired skills.

To reinforce the quality and effectiveness of this tutoring system, specific attention has been given to pedagogical support, in line with the 2018 Council of the European Union recommendation on a European framework for quality and effective apprenticeships. To this end, the local government of Tuscany provided tutor training based on best practices developed through previous bilateral cooperation initiatives between Germany and Italy. Both school-based and company tutors were trained on co-design methodologies, workplace learning strategies, feedback provision and performance assessment. This approach aimed to ensure that tutors were adequately prepared to facilitate high-quality dual training experiences and to support apprentices throughout their learning pathway.

To be eligible for the final examination and obtain the qualification certificate, apprentices must complete at least 75 % of both in-company and school-based training. In the event of early termination, acquired skills are validated if the apprentice has completed at least three months of training, in accordance with national certification standards under Legislative Decree No 13/2013.

From the first edition of the programme, the Bettino Ricasoli Institute collaborated with a staffing agency to act as the formal employer of apprentices and manage contract administration, thereby reducing the administrative burden on both the school and participating companies. This intermediary role improved the programme's operational efficiency and helped facilitate matching between students and firms.

Although regional financial support was temporarily unavailable during the 2023/2024 school year, the school continued to implement the dual pathway under the framework of higher education and research apprenticeship. This decision was taken in direct response to explicit requests from participating enterprises, which recognised the value of the dual model and expressed a strong interest in continuing this training arrangement. The continuation of the programme in the absence of dedicated public funding illustrates not only the institutional resilience of the school but also the level of commitment and ownership demonstrated by local employers. Notably, despite the continued availability of the standard school-based track, approximately 95 % of students enrolled in the wine technician specialisation programme have consistently opted for the apprenticeship-based model. This high level of preference highlights the perceived added value of the dual approach among both learners and enterprises, reinforcing its relevance as an effective instrument for aligning vocational education with labour market needs.

Although grounded in a national legal framework, the regional implementation has generated tangible results. It has strengthened cooperation between schools and enterprises, improved the alignment between training content and sectoral skill needs and facilitated earlier and more structured transitions into employment. By integrating technical education with work-based learning, the model contributes to the adaptability, continuity and quality of the regional VET system, while supporting the long-term sustainability and competitiveness of the wine sector.

The initiative has also attracted growing interest at the national level and is now considered a scalable solution for other regional contexts. Presentations at a national education fair (Fiera Didacta Italia) in both 2023 and 2024 and during dedicated events involving the national network of oenological schools, Assoenologi, and the Italian Ministry of Education and Merit have contributed to positioning the Tuscan experience as a reference model for the broader diffusion of dual apprenticeship pathways within post-secondary technical education in Italy. Despite its limited numerical scale, the programme has demonstrated significant potential to foster structured collaboration between education and industry, to support innovation in vocational training and to serve as a concrete example of how regional policy can activate systemic learning and policy transfer at national level.

10.4. Leveraging apprenticeship to transform regional skills ecosystems

10.4.1. Strengthening engagement in dual apprenticeship: evidence from employer and learner experiences in Tuscany

In the initial phase, company participation in the apprenticeship programme was limited, largely due to scepticism regarding the increased responsibilities demanded by this training model compared with traditional internships. However, direct involvement in hands-on training rapidly shifted employer perceptions. The second edition of the programme recorded a doubling in the number of participating companies. Survey data indicate that 71 % of respondents were small and medium-sized enterprises, with the remaining 29 % classified as large enterprises. Notably, 87 % of companies expressed strong satisfaction with the apprenticeship model and confirmed their intention to participate in future editions, many of which are already engaged in ongoing cohorts. Furthermore, 100 % of respondents agreed that the dual structure effectively balances in-company training and school-based education, with company organisational capacity identified as a key factor facilitating this integration.

A critical success factor has been the involvement of a staffing agency acting as an intermediary in managing apprenticeship contracts and coordinating relations between schools and employers. This arrangement has enhanced administrative efficiency and provided flexibility to meet both business and apprentice needs. The staffing agency's role has facilitated alignment between educational objectives and industry requirements, contributing to heightened employer satisfaction and smoother integration of apprentices within workplace environments.

While traditional viticulture enterprises play a vital role in preserving regional heritage, they pragmatically acknowledge the challenges associated with apprenticeships, particularly the need for specialised in-company tutors and the financial implications related to the supervision and training of apprentices.

From the students' perspective, the apprenticeship programme for wine technicians represents a pivotal component of vocational education, blending theoretical instruction with experiential learning in real-world settings. The integration of classroom education and hands-on practice within vineyards and wineries offers students a comprehensive understanding of viticulture processes, ranging from grape harvesting to fermentation and bottling. This dual approach enhances the practical applicability of academic knowledge, enabling students to acquire industry-relevant skills while simultaneously fostering a deepened theoretical understanding.

Many participants express aspirations to pursue careers in viticulture management, with a specific interest in either managing agricultural enterprises or establishing independent wineries. This reflects a clear alignment between the programme's learning outcomes and the labour market's demand for skilled professionals capable of navigating both traditional practices and emerging challenges within the sector, including sustainability and technological innovation.

While the students acknowledge the inherent challenges of balancing work responsibilities with academic study, they view these obstacles as crucial to their professional development. The experience not only enhances their technical and managerial capabilities but also equips them with the soft skills necessary for effective integration into the workforce.

Combined, these findings confirm that the dual apprenticeship model is not only effective in enhancing individual learning outcomes but also instrumental in strengthening employer engagement and aligning vocational training with evolving sectoral demands. More broadly, the evidence suggests that dual apprenticeship can function as a strategic policy tool for reinforcing skills ecosystems in specialised sectors, particularly when embedded within coherent institutional arrangements and sustained by strong stakeholder commitment.

10.4.2. **Policy recommendations for strengthening apprenticeship in the wine sector**

The Sienese wine sector provides a compelling case study of how targeted regional interventions – particularly through dual apprenticeship pathways – can enhance sectoral competitiveness and resilience. The implementation of the wine technician dual apprenticeship programme illustrates how education and training policies can be designed to closely align with the specific skill needs of a territorially embedded production system, while also fostering innovation and continuity in a sector deeply rooted in tradition.

From a policy perspective, the findings suggest that dual apprenticeship is not only an effective training pathway but also a strategic lever for improving the governance of sectoral skills ecosystems. As highlighted through the application of the VEM, apprenticeship schemes help activate and align key components of the ecosystem, such as training provision, institutional coordination and employer engagement. In the wine sector, this alignment has facilitated more cohesive collaboration among schools, enterprises and public authorities, thereby enhancing the responsiveness, coherence and long-term sustainability of the regional skills ecosystem.

The following policy recommendations are derived from the experience of the Tuscan pilot programme and aim to support the further development, consolidation and potential transferability of dual apprenticeship models within the wine sector. The focus is placed on operational and institutional levers that have proven effective in strengthening the design, delivery and governance of apprenticeship-based training.

10.4.2.1. *Reinforcing pedagogical support in wine sector apprenticeships*

The effectiveness of apprenticeship systems depends not only on structural design but also on the pedagogical capacity to combine school-based instruction with workplace learning. In the wine sector, this also depends on the ability of tutors in schools and companies to bridge theoretical content and evolving production practices. However, many educators face challenges in aligning their teaching with sectoral innovations due to limited exposure to modern viticulture techniques and insufficient training in dual-learning methodologies.

The Tuscan pilot experience in the Sienese wine sector demonstrates that strengthening pedagogical support is a key factor in improving apprenticeship quality. Targeted initiatives – such as joint training for school-based and company tutors, structured collaboration with wineries and immersive learning experiences in production environments – have proven effective in building this capacity. These efforts contribute to curriculum relevance, enhance coordination between learning sites and ensure that apprentices acquire competences aligned with current and future sectoral demands.

To consolidate and scale up this approach, regional and national authorities should invest in structured pedagogical support mechanisms tailored to the wine sector. These may include continuous professional development opportunities for tutors, incentives for industry–education partnerships and formal channels for integrating employer feedback into curriculum design. Reinforcing tutor capacity will not only strengthen the quality and consistency of dual programmes but also enhance the system's ability to support innovation, climate resilience and digital transformation in the wine industry.

10.4.2.2. *Strengthening vertical integration between apprenticeship-based and university-level training in the wine sector*

One of the long-term success factors for dual apprenticeship programmes in the wine sector is their capacity to support flexible and upwardly mobile learning pathways. As demonstrated in the Tuscan experience, the wine technician programme – implemented in a dual apprenticeship format – can serve as a gateway to higher-level roles and educational progression. However, the absence of formal linkages between vocational and university-level qualifications currently limits vertical permeability within the sector.

To address this, policy action should promote the development of structured articulation mechanisms between the wine technician programme and the university-level degree in oenology. This could include the recognition of learning outcomes through academic credit systems, enabling graduates from the dual pathway to access higher education with advanced standing. Such integration would enhance the

coherence of the qualifications framework and strengthen the role of dual apprenticeship within long-term career development strategies.

In addition to supporting learner progression, this approach would also elevate the status of the wine technician qualification itself, by acknowledging its advanced technical content and strong practical relevance. By bridging the gap between academic instruction and workplace learning, the system would become more attractive to students and more responsive to the wine industry's demand for highly skilled professionals.

10.4.2.3. *Facilitating transitions and specialisation pathways through dual apprenticeship in the wine sector*

Dual apprenticeship can play a strategic role in connecting diverse educational and training pathways within the wine sector, particularly when curricula are adapted to reflect local production needs and provide comprehensive exposure to the full value chain – from vineyard management to cellar operations. The Tuscan experience demonstrates that apprenticeship-based training enables learners to follow progressively specialised learning trajectories while acquiring both transversal and job-specific skills aligned with territorial vocations.

To enhance this integrative function, policy actions should promote greater vertical and horizontal permeability across vocational, technical and non-university tertiary education, by supporting flexible pathways anchored in work-based experience. Initiatives such as educational wineries – where students participate in all stages of the production process, from grape harvesting to bottling – can be effectively integrated into apprenticeship schemes to reinforce sector-specific competence development.

This approach helps address the fragmentation left by past reforms and contributes to the development of coherent, practice-oriented training pathways that are responsive to the evolving needs of wine enterprises. Moreover, it enhances the capacity of dual systems to function both as terminal qualifications and as platforms for further specialisation and entrepreneurial development.

10.4.2.4. *Integrating cross-cutting competences into wine sector apprenticeship programmes*

In a globalised and highly regulated industry, wine companies increasingly require professionals equipped not only with technical expertise but also with a set of cross-cutting competences. While the wine technician apprenticeship provides strong foundations in viticulture and oenology, skills gaps persist in areas such as foreign languages, regulatory and administrative frameworks, communication and marketing.

Dual apprenticeship schemes offer a strategic platform to integrate these interdisciplinary competences directly into workplace-based training. Unlike nationally regulated curricula – whose revision requires ministerial intervention – apprenticeship pathways enable more agile and context-responsive adjustments. The experience of Siena illustrates how this flexibility can be leveraged to incorporate forward-looking topics such as climate adaptation, the green and digital transitions and sustainability, through direct collaboration between training institutions and enterprises.

Policy measures should support the structured integration of these competences into apprenticeship curricula through co-design processes involving schools and employers, ensuring alignment with evolving industry requirements in areas such as international trade, compliance and market positioning.

To reinforce this adaptability, it is recommended that assessments of sector-specific skill needs be conducted regularly at the regional or national level. These mechanisms would enable timely curricular updates and enhance the responsiveness, innovation capacity and quality of apprenticeship programmes within the broader agrifood system.

10.5. Conclusions

This paper highlights that the future of viticulture and training in this field does not depend on pre-pack-

aged solutions, but rather on the ability to develop professionals capable of adapting to a continuously evolving sector. This requires not only solid technical preparation but also a strong disposition towards change, innovation and interinstitutional cooperation. In this regard, the growing awareness of the value of work-based learning is prompting both universities and specialised training providers to seek more integrated solutions. These efforts aim to facilitate the continuity of learners' educational pathways, including through more tangible recognition of credits earned in real-world contexts.

The wine technician apprenticeship programme in Tuscany illustrates how targeted regional interventions can strengthen the governance and responsiveness of skills ecosystems in specialised production sectors. Anchored in the national regulatory framework, yet shaped by deliberate regional investment and institutional coordination, the Tuscan initiative provides an effective model for aligning VET with sector-specific labour market needs.

This paper shows that apprenticeship emerges not only as a pedagogical solution but also as a strategic lever for systemic transformation, enabling the integration of training provision, employer engagement and policy coordination within the wine sector ecosystem. This dynamic role has been further explored through the application of the VEM, which underscores how apprenticeship can activate key nodes of the system, fostering innovation, continuity and collaboration across institutional boundaries.

The lessons drawn from the Sienese case hold broader relevance. Countries and regions seeking to modernise vocational training in traditional, yet evolving, sectors can benefit from similar approaches: those that combine national regulation with context-specific adaptation, sustained investment and institutional dialogue. Particularly in sectors where cultural heritage, innovation and sustainability intersect – such as wine production – dual apprenticeship offers a flexible and resilient training infrastructure capable of equipping future professionals with the skills needed to navigate complex transitions.

Further research is needed to examine the long-term impact of dual apprenticeship on workforce trajectories, particularly in terms of entrepreneurship, talent retention and mobility within the sector. Comparative studies could also help identify the institutional conditions under which apprenticeship most effectively reinforces skills ecosystems, offering guidance on developing more integrated and adaptive policy frameworks at the European level.

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Abbreviations

AI	artificial intelligence
BIBB	Federal Institute for Vocational Education and Training (*Bundesinstitut für Berufsbildung*) (Germany)
Cedefop	European Centre for the Development of Vocational Training
CFA	apprenticeship training centre (*Centre de Formation d'Apprentis*) (France)
CPNE-FP	national joint committee for employment and vocational training (*Commission Paritaire Nationale de l'Emploi et de la Formation Professionnelle*) (France)
CSCS	construction skills certification scheme
CVET	continuing vocational education and training
DREETS	regional directorate for the economy, employment, labour and solidarity (*Direction régionale de l'économie, de l'emploi, du travail et de la solidarité*) (France)
ECEC	early childhood education and care
EFBWW	European Federation of Building and Woodworkers
EFQEA	European framework for quality and effective apprenticeships
EQF	European qualifications framework
ESCO	European Skills, Competences, Qualifications and Occupations
ESDC	Employment and Social Development Canada
EU-LFS	EU Labour Force Survey
Eurostat	statistical office of the European Union
GYO	grow your own
ICT	information and communications technology
ICTC	Information and Communications Technology Council (Canada)
ILO	International Labour Organization
INAPP	National Institute for Public Policy Analysis
ISCED	International Standard Classification of Education
IT	information technology
IVET	initial vocational education and training
NCTR	National Center for Teacher Residencies (United States)

NFQ	national framework of qualifications (Ireland)
OECD	Organisation for Economic Co-operation and Development
OPCO Santé	skills operator for healthcare (*Opérateur de Compétences Santé*) (France)
OSH	occupational safety and health
PflBG	Nursing Professions Act (*Pflegeberufegesetz*) (Germany)
PIPSC	Professional Institute of the Public Service of Canada
RAG	retrieval-augmented generation
RAP	registered apprenticeship programme
Scaffold	Improving training, working conditions, and transformation in the European scaffolding sector
SOC	Standard Occupational Classification
SOLAS	Irish Further Education and Training Authority
VEM	viticulture ecosystem model
VET	vocational education and training
WEA ART	Washington Education Association apprenticeship residency in teaching
WIL	work-integrated learning

EN

New fields for apprenticeship

Insights for successful expansion of apprenticeships to new sectors and occupations

Apprenticeship, being particularly effective in delivering the skills and qualifications that individuals need in today's economies and societies, has been expanding to new fields: occupations or sectors that have not typically been accessed through apprenticeship training. This publication captures the experiences of such expansion efforts, drawing useful lessons on the objectives, processes and outcomes of such initiatives. It therefore provides valuable insights to support better-informed decisions that can maximise the benefits for learners, employers, sectors and societies.

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